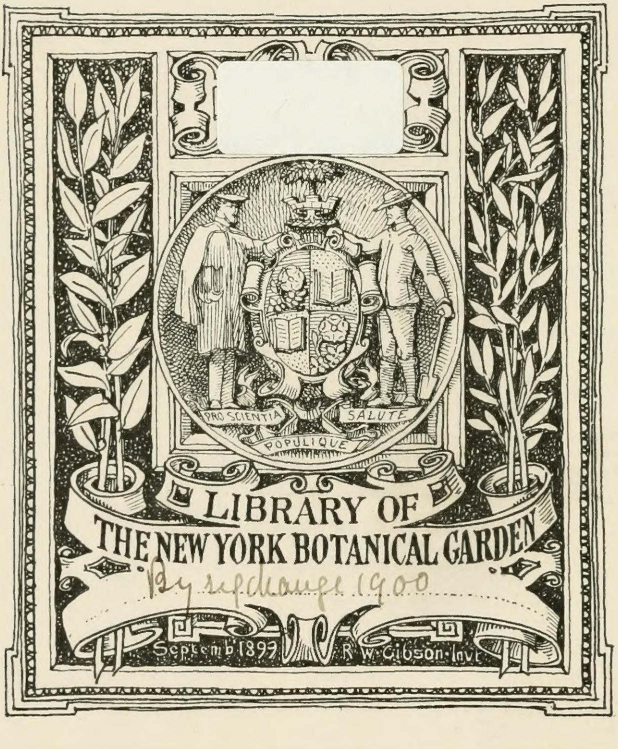
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THIRTY-EIGHTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

AND

TWELFTH ANNUAL REPORT

OF THE

LIBRARY,
NEW YORK
BOTANICAL
GARDEN.

ERRATA.

Report of the Librarian, page 73, should have been placed with department reports following page 51.

Report of the State Inspector of Nurseries, pages 74 and 75, and the list of Nurserymen, pages 75-77, should have been placed with the general reports immediately following page 433.

BY AUTHORITY

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1899

THIRTY-EIGHTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

AND

TWELFTH ANNUAL REPORT

OF THE

EXPERIMENT STATION

FROM

JULY 1, 1898, TO JUNE 30, 1899

LIBRARY,
NEW YORK
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REPORT OF THE SECRETARY

OF THE

LIBRARY
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BOTANICAL
GARDEN

STATE BOARD OF AGRICULTURE

AGRICULTURAL COLLEGE,
July 1, 1899.

TO HONORABLE HAZEN S. PINGREE,
Governor of the State of Michigan:

SIR—I have the honor to submit to you herewith, as required by statute, the accompanying report for the fiscal year ending June 30, 1899, with supplementary papers. Of this period, seven and three-fourths months were previous to my succession to the office of Secretary of the State Board of Agriculture.

Very respectfully,
ARTHUR C. BIRD,
Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

	Term expires.
THOMAS F. MARSTON, Bay City,	1903
President of the Board.	
FRANKLIN WELLS, Constantine,	1901
CHAS. J. MONROE, South Haven,	1901
*ARTHUR C. BIRD, Highland,	1903
EDWARD P. ALLEN, Ypsilanti,	1903
HENRY F. MARSH, Allegan,	1905
L. WHITNEY WATKINS, Manchester,	1905
HAZEN S. PINGREE, Governor of the State,	*Ex officio.*
JONATHAN L. SNYDER, Pres. of the College,	

ARTHUR C. BIRD, Agricultural College, Secretary.
BENJAMIN F. DAVIS, Lansing, Treasurer.

*Resigned January 25, 1899.

STANDING COMMITTEES.

The President of the Board is *ex officio* a member of each of the Standing Committees.

Finance,	H. F. Marsh, C. J. Monroe.
Farm Management,	Franklin Wells, L. W. Watkins.
Botany and Horticulture,	L. W. Watkins, C. J. Monroe.
Buildings and Property,	H. F. Marsh, Franklin Wells.
Employees,	E. P. Allen, H. F. Marsh, J. L. Snyder.
Farmers' Institutes,	C. J. Monroe, Franklin Wells.
Mechanical Department,	H. F. Marsh, L. W. Watkins.
Military and Athletics,	L. W. Watkins, E. P. Allen.
College Land Grant,	Franklin Wells, C. J. Monroe.
State Weather Service,	C. J. Monroe, L. W. Watkins.
Experiment Station,	L. W. Watkins, E. P. Allen.
Library,	E. P. Allen, H. F. Marsh.
Women's Department,	C. J. Monroe, E. P. Allen.
Chemical and Other Academic Departments not Otherwise Provided for,	Franklin Wells, H. F. Marsh.

STATE AGRICULTURAL COLLEGE.

(Under Control of the State Board of Agriculture.)

FACULTY AND OTHER OFFICERS.

Jonathan L. Snyder, Ph., D., President; [a,b,c] Feb. 25, '96.

Robert C. Kedzie, M. A., M. D., D. Sc., Professor of Chemistry and Curator of the Chemical Laboratory; [a,b,c] Feb. 25, '63.

Wm. J. Beal, A. M., M. S., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum; [a,b] July 9, '70, [c] Feb. 22, '71.

Levi R. Taft, M. S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department; [a,b,c] Aug 1, '88.

Howard Edwards, M. A., LL. D., Professor of English Literature and Modern Languages; [a,b,c] Aug. 25, '90.

Herman K. Vedder, C. E., Professor of Mathematics and Civil Engineering; [a,b,c] Sept. 15, '91.

Ira H. Butterfield, Secretary; [a,b,c] July 1, '93; [c] Feb. 22, '99.

Clinton D. Smith, M. S., Professor of Practical Agriculture and Superintendent of the Farm; [a,b,c] Sept. 1, '93.

Chas. L. Weil, S. B., Professor of Mechanical Engineering and Director of the Mechanical Department, [a,b,c] Sept. 1, '93.

Walter B. Barrows, S. B., Professor of Zoölogy and Physiology, and Curator of the General Museum; [a,b,c] Feb. 15, '94.

George A. Waterman, B. S., V. S., Professor of Veterinary Science; [a,b,c] Sept. 1, '98.

Maud Ryland Keller, A. M., Dean of the Women's Department; [a,b,c] Sept. 1, '98.

Arthur C. Bird, B. S., M. Ag., Secretary; [a,b,c] Feb. 22, '99.

Frank S. Kedzie, M. S., Adjunct Professor of Chemistry; [a,b] Sept. 15, '80; [c] Jan. 1, '91.

Philip B. Woodworth, B. S., M. E., Assistant Professor of Physics; [a,b] May 22, '87; [c] Aug. 7, '89.

William S. Holdsworth, B. S., Assistant Professor of Drawing; [a] Feb. 22, '81; [b] Aug. 22, '87; [c] Jan. 1, '90.

Alvin B. Noble, Ph. B., Assistant Professor of English Literature and Modern Languages; [a,b,c] Sept. 1, '89; [d] Sept. 1, '98.

Wilbur O. Hedrick, B. S., Assistant Professor of History and Political Economy; [a,b] Aug. 24, '91; [c] Sept. 1, '93.

Warren Babcock, B. S., Assistant Professor of Mathematics; [a,b] June 30, '91; [c] Sept. 1, '93.

Herbert W. Mumford, B. S., Assistant Professor of Animal Husbandry; [a] Sept. '95; [b,c] Dec. 1, '96; [d] Dec. 1, '97. Elected Professor of Agriculture and Superintendent of Farm June 14, '99, to take effect July 1, '99.

Georgiana Blunt, Ph. M., Assistant Professor of English and Modern Languages; [a,b,c] Sept. 1, '98.

Harry P. Gladden, B. S., Assistant Professor of Horticulture; [a,b,c] Mar. 23, '99; [d] July 1, '99.

Charles F. Wheeler, B. S., Instructor in Botany; [a,b] Mar. 1, '90; [c] May 1, '93.

A. L. Westcott, B. M. E., Instructor in Mechanical Engineering; [a,b,c] June 1, '93.

Dick J. Crosby, B. S., Instructor in English; [a,b,c] Sept. 1, '93.

Burton O. Longyear, Instructor in Botany; [a,b,c] Feb. 15, '94.

Merrit W. Fulton, B. S., Instructor in Agriculture; [a,b,c] Sept. 15, '95; [d] Dec. 1, '99.

Gordon H. True, B. S., Instructor in Dairying; [a,b,c] Sept 1, '94.

H. E. Smith, Instructor in Mechanics; [a,b,c] Sept. 1, '96.

Rufus H. Pettit, B. S. A., Instructor in Zoölogy; [a,b,c] Feb. 1, '97.

Mrs. Maud A. Marshall, Instructor in Music; [a,b,c] Sept. 1, 97.

Mrs. Jennie L. K. Hanier, Instructor in Sewing; [a,b,c] Sept. 1, '97.

William O. Beal, B. S., M. A., Instructor in Mathematics; [a,b,c] Sept. 1, '97.

Carrie L. Holt, Instructor in Drawing; [a,b,c] Sept. 1, 98.

Ellen R. Rushmore, Instructor in Domestic Science; [a,b,c] Sept. 1, '98.

Frank V. Warren, B. S., Instructor in Mathematics; [a,b,c] Sept. 1, '98; [d] Sept 1, '99.

Mrs. Linda E. Landon, Librarian; [a,b,c] Aug. 24, '91.

Thomas Gunson, Foreman of Greenhouse; [a,b] April 1, '91; [c] Sept. 1, '91.

Charles A. Wood, Foreman of the Horticultural Department; [a,b,c] May 1, '98.

Fred C. Kenney, Cashier; [a,b] Sept. 18, '95; [c] Oct. 1, '97.

Charles H. Alvord, B. S., Foreman of the Farm; [a,b,c] April 1, '98.

W. R. Bradford, Foreman of the Wood Shop; [a,b,c] Nov. 1, '97.

W. S. Leonard, Foreman of the Machine Shop; [a,b,c] Sept. 1, '96.

E. C. Baker, Foreman of the Foundry; [a,b,c] Nov. 1, '97.

L. F. Newell, Engineer; [a b c] Jan. 1, '98.

Chace Newman, Assistant Foreman of Wood Shop; [a b c] Dec. 1, '92.

Edwin S. Good, Clerk to President; [a b c] July 15, '96.

Kenyon L. Butterfield, B. S., Supt. Institutes and College Field Agent; [a b c] June 1, '95; [e] July 1, '99.

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[a] First appointment.
[b] Present appointment.
[c] Present title.
[d] Resignation.
[e] Term expired.

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE.

[Under the control of the State Board of Agriculture.]

STATION COUNCIL.

Clinton D. Smith, M. S.,	Director.	Robt. C. Kedzie, M. A., M. D., D. Sc.,	Chemist.
J. D. Towar, B. S.,	Agriculturist.	A. C. Bird, B. S., M. Ag.,	Sec. and Treas.
L. R. Taft, M. S.,	Horticulturist.	J. L. Snyder, Pres.,	*Ex officio* Member.

ADVISORY AND ASSISTANT STAFF.

H. W. Mumford, B. S.,	Asst. in Agriculture.	Chas. F. Wheeler, B. S.,	Cons. Botanist.
H. P. Gladden, B. S., (*a*)	" Horticulture.	C. E. Marshall, Ph. B.,	Asst. Bacteriologist.
M. L. Dean,	" Horticulture.	R. H. Pettit, B. S. A.,	" Entomologist.
L. S. Munson, B. S.,	" Chemistry.	S. H. Fulton, B. S.,	In charge of South Haven Sub-Station.
Geo. A. Waterman, V. S.,	Consulting Veterinarian.	Mrs. L. E. Landon,	Librarian.
W. B. Barrows,	Consulting Zoölogist.	C. S. Brooks, (*b*)	Foreman Poultry Dept.

SUB-STATIONS.

Grayling, Crawford county, 80 acres deeded.

South Haven, Van Buren county, 10 acres rented; 5 acres deeded; Local Agent, S. H. Fulton, B. S.

STATE WEATHER SERVICE.

[Under the control of the State Board of Agriculture.]

OFFICERS OF THE SERVICE.

Director, - - - - - - C. F. Schneider, U. S. Weather Service, Lansing.

STANDING COMMITTEE IN CHARGE.

Hon. L. Whitney Watkins,	Manchester.
Hon. Edward P. Allen,	Ypsilanti.

(*a*) Resigned to take effect July 1, 1899.

(*b*) Term expired July 1, 1899.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

SECRETARY'S FINANCIAL REPORT.

			Dr.	Cr.
July 1, 1898.	To cash on hand		$1,745 41	
" 1, 1898.	To cash on deposit with treasurer		3,574 39	
" 1, 1898.	To cash on deposit with New York bank		441 14	
" 1, 1898.	By balance due students on deposit accounts			$1,267 68
June 30, 1899.	To special appropriation receipts:			
	From State Treasurer	$11,750 00		
	From United States Treasurer	15,000 00		
	From institution	2,419 26		
			29,169 26	
June 30, 1899.	By special appropriation disbursements			28,641 50
" 30, 1899.	To current account receipts:			
	From State Treasurer	$50,000 00		
	From United States Treasurer	24,000 00		
	From institution	24,063 22		
			98,063 22	
June 30, 1899.	By current account disbursements			105,910 74
" 30, 1899.	To balance due students on deposits		1,149 21	
" 30, 1899.	To balance due on nursery inspection		95 00	
" 30, 1899.	To college treasurer (overdraft)		2,764 07	
" 30, 1899.	By cash on deposit with New York bank			265 52
" 30, 1899.	By cash on hand			916 26
			$137,001 70	$137,001 70

TABLE NO. 1.—*Tabular Exhibit of Secretary's Report.*

Name of account.	Balance sheet, July 1, 1898.		Transactions July 1, 1898, to June 30, 1899.		Balance sheet, June 30, 1899.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$2.168 55			$1,004 77	$1,181 78	
College treasurer *	3,574 39			6,338 46		$2.764 07
Students' deposits		$1,267 68	$118 47			1,149 21
Special appropriations		324 18	28.641 50	29,169 26		851 94
General current		4,168 08	105,910 74	98,063 22	3,678 44	
Nursery license				95 00		95 00
Totals	$5,760 94	$5,760 94	$134,670 71	$134,670 71	$4,860 22	$4,860 22

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* Treasurer's statement is greater July 1, 1898, by $3,349.98, and June 30, 1899, by $9,573.14, warrants outstanding less credits by remittance in transit of $2,895.17.

TREASURER'S ACCOUNT.

	Dr.	Cr.
Balance July 1, 1898	$6,924 27	
Receipts from State Treasurer and Secretary	156,467 07	
Interest on deposits, 13 months at 3 per cent	308 91	
Warrants paid July 1, 1898 to June 30, 1899		$159,787 35
Balance on hand June 30, 1899		3,912 90
	$163,700 25	$163,700 25

TABLE NO. 2.—*Statement of special appropriation account for fiscal year July 1, 1898, to June 30, 1899.*

Name of appropriation.	Balance of account July 1, 1898.		Receipts during fiscal year.		Total available.	Total expended.	Balance of account June 30, 1899.	
	Dr.	Cr.	From State treasury.	From institution.				
Experiment station		$1,700 52	* $15,000 00	$2,363 07	$19,063 59	$18,167 93		$895 66
Weather service		72 79	750 00		822 79	885 99	$63 20	
Repairs of buildings	$620 26		3,000 00	56 19	2,435 93	2,416 45		19 48
Institute			5,500 00		5,500 00	5,500 00		
Student Labor	828 87		2,500 00		1,671 13	1,671 13		
Balance	324 18						851 94	
	$1,773 31	$1,773 31	$26,750 00	$2,419 26	$29,493 44	$28,641 50	$915 14	$915 14

* $15,000.00 from U. S. treasurer direct.

TABLE NO. 3.—*Current account July 1, 1898, to June 30, 1899.*

On account of—	Dr. To disbursements.	Cr. By receipts.
United States treasurer, tenth annual payment under act of congress of August 30, 1890		$24,000 00
State treasurer, interest on proceeds of sales of U. S. land grant		50,000 00
Students' class fees		10,538 01
Salaries paid	$45,047 91	
Farm department	9,185 59	5,600 07
Horticultural department	4,301 81	1,221 53
Mechanical department	3,181 21	
Heating, cleaning and lighting	15,889 28	
Academic department	6,944 08	
Office, postage, stationery and advertising	5,255 56	
Delta land sales		1,086 57
Sundry	4,860 74	5,298 38
Interest and exchange		318 66
Building account	11,244 56	
	$105,910 74	$98,063 22
Balance at beginning of period July 1, 1898		4,169 08
Balance at close of period June 30, 1899		3,678 44
	$105,910 74	$105,910 74

TABLE NO. 4.—*Experiment station account July 1, 1898, to June 30, 1899.*

On account of—	Dr. To disbursements.	Cr. By receipts.
Balance from last fiscal year		$1,700 52
United States treasurer for fiscal year		15,000 00
Fertilizer, license fees and expenses		1,460 00
Salaries paid	$9,011 57	
Farm department	4,173 90	865 40
Horticultural department	805 73	
Chemical department	322 21	
Botanical department	5 65	
Zoölogical department	13 63	
Veterinary department	755 20	
Buildings department	131 34	
Library department	254 59	
Sundry	81 46	37 67
Offices	501 84	
South Haven sub-station	1,938 77	
Apiary	172 04	
Balance on hand at close of fiscal year	895 66	
	$19,063 59	$19,063 59

TABLE NO. 5.—*Employees and salaries.*

OFFICER.	Rate per year.	Classification.		Other Sources.	
		Current.	Experim't Station.		
President	$3 200 00	$3,200 00			and dwelling.
Professor chemistry	2,000 00	1,700 00	$300 00		“ “
“ botany	1,800 00	1,800 00			“ “
“ agriculture	2,300 00	1,200 00	1,100 00		“ “
“ horticulture	1,800 00	1,200 00	600 00		“ “
“ mathematics	1,800 00	1,800 00			“ “
“ mechanical engineering	1,800 00	1,800 00			“ “
“ zoölogy	1.800 00	1,800 00			“ “
“ veterinary science	1,500 00	1,200 00	300 00		
“ English	1,800 00	1,800 00			and dwelling.
Adjunct professor chemistry	1,800 00	1,800 00			
Assistant professor physics	1,250 00	1,250 00			and rooms.
“ “ drawing	1,250 00	1,250 00			“ “
Secretary	1,800 00	300 00	500 00	$1,000 00	and dwelling.
Assistant secretary, to Jan. 1, 1899	1,200 00	1,200 00			
Librarian	725 00	605 00	120 00		and rooms.
Assistant professor English	800 00	800 00			“ “
“ “ mathematics	1,000 00	1,000 00			“ “
“ “ history and political economy	900 00	900 00			“ “
Assistant professor botany	1,000 00	500 00	500 00		“ “
“ “ animal husbandry	1,500 00	1,000 00	500 00		
“ “ bacteriology	1,200 00	200 00	1,000 00		
Dean of woman's department	1,000 00	1,000 00			and room.
Instructor in domestic science	600 00	600 00			“ “
Instructor in sewing	500 00	500 00			“ “
“ “ music	500 00	500 00			
“ “ drawing	400 00	400 00			
“ “ mechanical engineering	800 00	800 00			and rooms.
“ “ English	500 00	500 00			“ room.
“ “ botany	550 00	550 00			
“ “ mathematics	550 00	550 00			
Assistant instructor in mathematics	550 00	550 00			
Instructor in dairying	800 00	400 00	400 00		and room.
“ “ mechanics	700 00	700 00			
“ “ zoölogy	1,000 00	500 00	500 00		and house.
“ “ mechanical drawing	500 00	500 00			
College field agent	600 00	600 00			
Cashier	800 00	800 00			
Engineer	600 00			Heating. 600 00	and rooms.
Florist	800 00	800 00			“ house.
Foreman farm	600 00	600 00			“ “
“ horticultural department	500 00	500 00			“ “
“ wood shop	600 00	600 00			
“ machine shop	850 00	850 00			
“ foundry	468 00	468 00			
Clerk in P. O., to Feb. 22, 1899	500 00	500 00			and room.
“ president	500 00	500 00			“ “
“ mechanical department	420 00	420 00			
“ to secretary	360 00	360 00			
Herdsman	420 00	420 00			and board.
Assistant greenhouse	420 00			Hort. dept. 420 00	
Agriculturist	1,500 00		1,500 00		
Assistant in horticulture	800 00		800 00		
“ “ “	700 00		700 00		
“ “ chemistry	500 00		500 00		and rooms.
Professor military science	1,800 00	Pd by U. S.		1,800 00	“ “
Night watchman	420 00	420 00			
Totals	$57,333 00	$44,193 00	$9,320 00	$3,820 00	

TABLE NO. 6.—*Detailed statement of Legislative*

Object.	Total.	1899.	1897.	1895.	1893.
Buildings	$351,325 00	Women's dormitory $83,000 Furnishing dormitory 12,000 Dairy building 15,000 Farm barn 4 000 Heating apparatus 2,500 Fire escapes 500 $117,000 00	Electric light plant $5,000 Bath room, Abbot hall 200 $5,200 00	Closets $3,000 00	Equip. botanical lab. $1,000 Foundry 1,500 Hospital 2,500 $5,000 00
General account	466,211 48				
Repairs	87,428 60	10,000 00	12,000 00	12,000 00	13,500 00
Library	25,055 00				2,000 00
Farm	27,075 64				900 00
Garden	12,041 00				200 00
Greenhouse	2,765 00				
Botany	5,331 00				
Chemistry	13 955 00				
Zoölogy	10,296 00				225 00
Veterinary	2,586 00				
Mathematics	6,090 00				500 00
Mechanical	15,200 00				
Steam and water	20,832 00				
Institutes	31,800 00	11,000 00	11,000 00	10,000 00	4,000 00
Student labor	58,000 00	5,000 00	5,000 00	8,000 00	8,000 00
Weather service	21,937 50	2,000 00	2,000 00	2,000 00	
Sundry	8,960 00				3,400 00
Totals	$1,166,889 22	$145,000 00	$35,200 00	$35,000 00	$37,725 00
Annual tax on each $1,000 of assessment	† $0.552	$0.0638	$0.0155	$0.0155	$0.01⅔
* Aggregate tax to date on each $1,000 of assessment		$3.3792	$2.0989	$2.0679	$2.0369
Assessed valuation of State in millions of dollars		1,105.10	1,105.10	1,130	1,130

* Counting only taxes actually levied and omitting land grants.

† Average.

appropriations to the State Agricultural College.

1891.	1889.	1887.	1885.	1883.	1881.	1879.	1877.	1855–75.
Botanical laboratory .. $10,000 Heating apparatus ..... 1,950 Greenhouse 4,500	Agricultural laboratory . $8,000 Sundry 1,800	Howard terrace ..... $10,000 Abbot hall ..... 10,000 Horticultural labt'y ..... 5,000 Mechanical labt'y ..... 3,000 Bridge, etc 2,100	Mechanical laboratory .. $7,800 Veterinary laboratory ... 5,400 Armory ..... 5,000 One dwelling 4,000	Boiler house ..... $5,000 One dwelling 3,000	Library ..... $25,000 Chemical labt'y add ..... 6,000 Barns 2,775	Botanical laboratory ... $6,000 One dwelling 3,000	Wells' hall $25,000	Williams hall, 1869 ..... $30,000 Chemical labt'y, 1871 .. 10,000 Greenhouse, 1873 ..... 8,000 Three dwellings ..... 18,000 Bridges 800
$16,450 00	$9,800 00	$30,100 00	$22,200 00	$8,000 00	$33,775 00	$9,000 00	$25,000 00	$66,800 00
				16,770 00	14,498 00	9,943 60	12,300 00	413,143 97
7,800 00	5,000 00	1,400 00	3,147 00	6,720 00	1,576 00	1,290 00	3,691 60	9,264 00
2,000 00	3,000 00	3,000 00	3,300 00	3,125 00	3,000 00	2,000 00	1,190 00	2,440 00
2,100 00	800 00	2,815 00	4,810 00	3,389 00	4,175 00	4,016 64	2,400 00	1,670 00
570 00	500 00	1,250 00	432 00	1,342 00	3,220 00	2,810 00	947 00	720 00
530 00	600 00	340 00	1,295 00					
500 00	1,000 00	800 00	800 00	2,231 00				
500 00	1,500 00	2,000 00	2,500 00	1,000 00	3,000 00	1,000 00	1,380 00	1,075 00
700 00	1,500 00	1,500 00	1,500 00	1,945 00	1,000 00	800 00	480 00	646 00
100 00	200 00	200 00	2,086 00					
200 00	475 00	600 00	450 00	700 00	2,020 00	1,020 00	125 00	
1,500 00	3,200 00	4,000 00	5,200 00	1,000 00	300 00			
2,045 00	2,920 00	7,500 00	1,400 00	4,267 00				2,700 00
1,500 00	800 00	600 00	600 00	600 00	600 00	600 00	500 00	
8,000 00	8,000 00	8,000 00	8,000 00					
	8,350 00	8,587 50						
1,400 00	500 00	2,100 00				600 00	660 00	300 00
$45,895 00	$48,145 00	$74,792 50	$57,720 00	$51,089 00	$67,164 00	$33,080 24	$48,673 60	$498,558 97
$0.02	$0.02½	$0.04	$0.03⅓	$0.04 1-7	$0.04 1-7	$0.02⅝	$0.04	$0.0747
$2.0036	$1.963	$1.912	$1.833	$1.7657	$1.7026	$1.6197	$1.5672	$1.4407
1,330	945.45	945.45	810	810	810	630	630	137 to 630

TABLE No. 7.—*Income of the State Agricultural College from all outside sources from the date of its foundation to the present time.*

Year.	From State Legislature.			From U. S. Congress.			Total.
	For current expenses.	For special purposes.	Land sales, salt spring and swamp land grants.	Morrill act of 1862, interest from land grant.	Hatch act of 1887, experiment station.	Morrill act of 1890, supplementary endowment.	
1855			$56,320 00				$56,320 00
1856							
1857	$40,000 00						40,000 00
1858							
1859	37,500 00						37,500 00
1860							
1861	6,500 00		152 25				6,652 25
1862	10,000 00		218 97				10,218 97
1863	9,000 00		407 80				9,407 80
1864	9,000 00		726 09				9,726 09
1865	15,000 00		1,156 61				16,156 61
1866	15,000 00		1,091 27				16,094 27
1867	20,000 00		7,608 38				27.608 38
1868	20,000 00		592 49				20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96			67,617 96
1870	20,000 00		1,320 02	2,720 93			24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84			36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65			28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06			48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98			42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14			29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17			32,996 76
1877	6,150 00	30,686. 80	979 06	15,172 86			52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09			28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22			38.730 56
1880	4.971 80	7,068 32	797 55	17,837 24			30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25			72,366 70
1882	7,249 00	8,945 50	358 46	22.507 45			39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60			63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72			48,080 62
1885		35,103 00	187 50	29,770 40			65,060 90
1886		22,617 00		30,461 04			63,078 04
1887		* 44,040 00	† 198 20	† 24,611 37			68,849 57
1888		30.752 50	144 20	32,406 60	$15.000 00		78,603 30
1889		* 20,973 00	10 50	31,322 69	15,000 00		67,306 19
1890		* 27,172 00	238 50	32,360 64	15.000 00	$15,000 00	89.771 14
1891		22,947 50	37 38	34,750 54	15,000 00	16,000 00	88,735 42
1892		22,947 50	137 38	34,948 12	15,000 00	17,000 00	90,033 00
1893		18,862 50	10 50	37,927 04	15.000 00	18,000 00	87,800 04
1894		18,862 50	433 59	44,527 26	15,000 00	19.000 00	95,823 35
1895		‡ 19,000 00	10 50	45.301 85	15,000 00	20.000 00	99,312 35
1896		‡ 16,000 00		44,037 25	15,000 00	21,000 00	96,037 25
1897		‖ 17,700 00		43,779 54	15 000 00	22,000 00	98,479 54
1898		¶ 17,500 00		45,190 17	15,000 09	23.000 00	100,690 17
1899‖‖		§ 8,750 00	705 00	50,402 90	15,000 00	24.000 00	98,152 90
Totals	$362,083 60	$578,937 74	$101,487 47	$799,830 57	$180,000 00	$195,000 00	$2,222,937 38

* Including appropriations for weather service.
† October 1, 1886, to June 30, 1887, nine months.
‡ Including $5,000 for institutes and $1,000 for weather service.
§ Including $2,750 for institutes and $500 for weather service.
‖ Including $5,500 for institutes and $1,000 for weather service.
¶ Including $5,500 for institutes and $1,000 for weather service.
‖‖ To June 30.

SUMMARY OF INVENTORY, JUNE 30, 1899.

College farm and park, 676 acres @ $70		$47,320 00
Buildings—		
Library and museum, built 1881	$22,000 00	
College hall, built 1856	16,000 00	
Williams hall, built 1869	30,000 00	
Wells hall, built 1877	20,000 00	
Abbot hall, built 1888, add. in 1896	15,000 00	
Chemical laboratory, built 1871, south end add. '81.	16,000 00	
Machine shops and foundry, 1885, so. end add. '87.	15,000 00	
Veterinary laboratory, built, 1885	5,000 00	
Horticultural laboratory, built 1888	6,000 00	
Agricultural laboratory, built 1889, imp. 1897	7,500 00	
Botanical laboratory, built 1892	10,000 00	
Armory, built 1885	6,000 00	
Greenhouse and stable, built 1873, 1879; rebuilt '92.	6,000 00	
Greenhouse, experiment, built 1889	1,300 00	
Boiler house and chimney, built 1893-4	4,000 00	
President's and two frame dwellings, built 1874	12,000 00	
Four brick dwellings, built 1857	10,000 00	
Two brick dwellings, built 1879 and 1884	6,000 00	
One frame dwelling, built 1885	3,500 00	
Howard terrace dwelling, built 1888	13,000 00	
Farm house dwelling, built 1869	2,000 00	
Herdsman's dwelling, built 1867	400 00	
Ten barns at professors' houses	2,000 00	
Horticultural barn and shed, built 1868, 1875, 1887.	1,200 00	
Cattle barn and shed, built 1862	1,500 00	
Sheep barn, built 1865	1,000 00	
Horse barn, built 1871	1,000 00	
Pig barn, built 1871	1,000 00	
Corn barn, built 1878	400 00	
Grain barn, built 1881	1,600 00	
Horse sheds, built 1894	200 00	
Tool barn, built 1881	1,000 00	
Barn, built 1884	800 00	
Brick work shop, built 1857	500 00	
Observatory, built 1880	150 00	
Bath house and fittings, built 1889	400 00	
Ice house, 1879	100 00	
Paint shop, built 1879	150 00	
Bee house, 1884, remodeled dwelling, 1893	700 00	
Hospital, 1894	3,000 00	
Poultry building and yards, 1894	625 00	
Dairy barn, built 1897	800 00	
Waiting room street car terminus, built 1897	80 00	
Street car track and fixtures, 600 ft., built 1897	360 00	
Lumber shed, mechanical dept	250 00	
Silo	210 00	
		245,725 00
Iron bridge over Cedar river, built 1888		1,500 00
Water works and steam works—		
Artesian well and connections, sunk '87, 343 ft. deep	$1,000 00	
Fire pump, 1883, $650; tank pump, 1881, $200	850 00	
Two hose carts and 4 nozzles, bought 1883-88	50 00	
2,378 ft. wood pipe, 6 in., laid 1883-87 2,623 ft. wood pipe, 4 in., laid 1883-87 662 ft. wood pipe, 3 in., laid 1883-87	1,531 00	
	3,431 00	
Carried forward		$294,545 00

Brought forward	$3,431 00	$294,545 00
Water works and steam works—*Continued:*		
Water tank and heater, built 1883	400 00	
Thirteen fire hydrants in place, built 1883-87	400 00	
Valves, fittings and connections, laid 1883-87	500 00	
Four boilers, 4 ft x 12 ft., built 1881	600 00	
Two boilers, 5 ft x 12 ft., built 1887	700 00	
Two small pumps, 1884-91	200 00	
Underground steam piping, laid 1882	2,500 00	
Miscellaneous tools and stock	235 64	
One water purifier	325 00	
Water meter	20 00	
Injector	20 00	
Main steam pipe, 1892	300 00	
Safety valve on water main	15 00	
One pile hammer	10 00	
Six service boxes, in place 1893	8 00	
Six lawn hydrants, in place 1894	25 00	
Five-inch exhaust head	10 00	
Three fire hydrants, 1898	18 00	
1,200 ft. 3 in. iron water main, 1898	160 00	
Steel benching, put in in 1895	265 00	
		10,142 64
Farm Department—		
Feed	$297 37	
Cattle	4,528 60	
Sheep, 70 head	842 00	
Horses	725 00	
Swine	214 00	
Tools, implements, scales, windmills, etc	1,344 33	
Class room, office and farm house equipment	2,292 40	
Experiment station	1,978 61	
Growing crops, estimated	994 00	
Dairy room	1,024 40	
		14,240 71
Horticultural Department—		
Grafting room	$4 00	
Pruning tools	10 30	
Teams, harness, etc	349 00	
Heavy tools	352 65	
Compost and manures	150 00	
Carpenters' tools	26 20	
Ice tools	30 50	
Office	40 00	
Class room	906 25	
Tool room	248 95	
Greenhouse plants	2,389 88	
Vegetable garden	59 25	
Laboratory, furniture, etc	43 00	
Experiment station	819 75	
Greenhouse tools	254 70	
Miscellaneous	80 00	
Work room	10 50	
		5,774 93
Mechanical Department—		
Class room and office equipment	$6,398 74	
Machine shop	7,816 38	
Wood shop	2,216 61	
Blacksmith shop and foundry	1,844 41	
		18,276 14
Carried forward		$342,979 42

Brought forward		$342,979 42
Chemical Department—		
Furniture, apparatus and chemicals	$10,956 51	
Experiment station	1,504 52	
		12,461 03
Botanical Department—		
Herbarium	$7,100 38	
Museum	900 75	
Office class apparatus and garden tools	3,215 05	
Experiment station	532 99	
		11,749 17
Mathematical and Engineering Department—		
Surveying instruments	$2,002 98	
Telescope and accessories	839 75	
Furniture, apparatus, etc	867 74	
Photographic material	50 95	
Office furniture	278 51	
		4,039 93
Library, exclusive of experiment station library—		
19,862 books and pamphlets	$38,823 00	
Sunday school books	140 00	
Portrait and pictures	908 00	
Furniture	942 83	
		40,813 83
Physical Department—Fixtures and apparatus	$7,077 25	
Veterinary laboratory—Museum furniture and apparatus	1,796 40	
Zoölogical Department—Furniture and apparatus	1,720 60	
General Museum—Collections and cases	17,475 00	
College hall furniture and English department	985 50	
Drawing	979 25	
Public parlor furniture, $50.80; hospital furniture, $29.20	80 00	
Club boarding association, 15 shares stock	... ..	
President's office	463 45	
Secretary's office	1,005 00	
Weather service	1,937 10	
Armory—Furniture and equipment	697 90	
Abbot hall—Furniture and fixtures	1,764 35	
State Board of Agriculture rooms	341 69	
Farmers' institute	245 86	
Athletic apparatus	202 55	
Electric light plant, complete	5,000 00	
One dynamo at agricultural laboratory	280 00	
Advertising	37 00	
		42,088 90
Experiment station		25,271 58
		$479,403 75

United States property held in trust—		
Two 3-in. rifled guns and equipments	$1,573 55	
250 Springfield rifles, complete	3,750 00	
250 rifle equipments	665 00	
Reloading tools, chests, tarpaulins, etc	83 55	
		$6,072 10

SUMMARY OF EXPERIMENT STATION INVENTORY.

Lands donated to the Station—		
80 acres at Grayling, fenced and improved at cost.	$1,000 00	
5 acres at South Haven, fenced and improved	1,000 00	
		$2,000 00
Buildings—		
Experiment feed barn	$800 00	
Horticultural laboratory, experimental rooms	1,200 00	
Veterinary laboratory, experimental rooms	250 00	
Apiary	600 00	
Forcing houses, $1.500.00-$600.00	2,100 00	
Feed mill	100 00	
Sub faculty building	3.000 00	
Seed room	980 00	
Poultry house and yards	625 00	
Dairy room in agricultural laboratory	250 00	
Storage barn	600 00	
Cold storage fruit house	1.500 00	
		12,005 00
Library and office of secretary—		
1,795 books	$3,706 10	
Furniture and mailing list in type	125 00	
		3,831 10
Farm Department—		
Office	$354 65	
Tools and seeds	560 31	
Poultry	359 25	
Dairy room	74 00	
Growing crops	145 50	
Stock	100 00	
Apiary	306 90	
Class room	10 00	
Fertilizers	68 00	
		1,978 61
Horticultural Department—		
Office, furniture, implements, etc	$639 75	
One team	180 00	
		819 75
Chemical Department—		
Porcelain	$26 20	
Glassware	105 50	
Furniture and fixtures	156 50	
Chemicals	55 55	
Apparatus	1,160 77	
		1,504 52
Botanical Department—		
Microscopes and accessories	$316 88	
Furniture and sundry apparatus	216 11	
		532 99
Bacteriological Department—		
Instrument and sundry apparatus	$1,667 10	
Chemicals	260 00	
		1,927 10
Zoölogical Department—		
Microscopes, cases, etc		672 50
		$25.271 57

DEPARTMENT REPORTS.

REPORT OF THE PRESIDENT.

To the Honorable State Board of Agriculture:

I take pleasure in submitting herewith my report as president of the College for the year ending June 30th, 1899.

The work of the year just closed has been very satisfactory. The attendance has been much larger than ever before, reaching 535 for the year.

Of this number, 192 were enrolled in the four year agricultural course; 172 in the mechanical course, and 93 in the course for young women. Sixty-eight young men attended the special courses given during the winter.

The average grade of work done in all departments was quite satisfactory. The deportment of students was good. It was not found necessary to suspend or expel a student during the entire year.

The following twenty-nine persons were graduated with the degree of Bachelor of Science, on June 16:

Name.	Postoffice.	County.
Agnew, R. Manning. m	Chesaning,	Saginaw.
Austen, Clift F.,	Elbridge,	Oceana.
Belliss, Marie, w	Ionia,	Ionia.
Brainerd, Walton K.,	Brady,	Saginaw.
Bristol, Teresa A., w	Almont,	Lapeer.
Bulkeley, Joseph A.,	Wallerawang,	New South Wales, Aus.
Calkins, Chas. E.,	Swartz Creek,	Genesee.
Crane, Fred R.,	Frankfort,	Berrien.
Edwards, S. Fred,	Milan,	Washtenaw.
Flynn, Walter H., m	St. Thomas,	Ontario.
Gagnier, Edward D., m	Detroit,	Wayne.
Gould, Geo. N.,	Saranac,	Ionia.
Hurd, William D.,	Lansing,	Ingham.
Ingerson, Seymour L.,	Hopkins Station,	Allegan.
Johnson, Charles,	Agricultural College,	Ingham.
Kedzie, W. Roscoe,	Lansing,	Ingham.
Krentel, Adorf B.,	Agricultural College,	Ingham.
Krentel, Alex C.,	Agricultural College,	Ingham.
Krentel, Christian M.,	Agricultural College,	Ingham.
Lapham, Macy H.,	Okemos,	Ingham.
Lowry, Fred N., m	Norvell,	Jackson.
Rose, Philip S., m	Summit City,	Grand Traverse.
Russell, Edward R., m	Kalamazoo,	Kalamazoo.
Severance, John,	East Jordon,	Charlevoix.
Stone, Allan H., m	Lansing,	Ingham.
Swift, A. Thorne,	Harbor Springs,	Emmet.
West, Francis E.,	Attica,	Lapeer.
Wheeler, Fay, w	Agricultural College,	Ingham.
McDermott, J. L.	Buckner,	Missouri.

The degree of Master of Science, in course, was conferred upon Miss Lillian Wheeler of the class of '93.

The baccalaureate sermon was given in the Armory on June 11th by President John Henry Barrows, D. D., of Oberlin College. President Andrew S. Draper, of the University of Illinois, delivered the commencement address.

At the close of last year, Miss Edith F. McDermott, who had held the position of Professor of Domestic Science and Household Economy during the last two years, resigned. The department was reorganized and Miss Maud Ryland Keller, A. M., a graduate of Wellesley College, was placed in charge as Dean. Miss Ellen R. Rushmore, a graduate of Drexel Institute, was employed as teacher of Domestic Science.

Miss Georgiana C. Blunt, Ph. M., a graduate of the University of Michigan, was elected assistant Professor of English and Modern Languages, the position vacated by Prof. A. B. Noble, who resigned to accept the Chair of English in the Iowa Agricultural College, Ames, Iowa. Miss Carrie L. Holt was elected instructor in Drawing; Mr. Frank V. Warren instructor in Mathematics; Miss Bertha M. Ronan, a graduate of the Michigan Normal College, instructor in Calisthenics. Faithful and efficient work has been done by all of those recently added to the faculty.

The College received generous treatment at the hands of the legislature during its last session. Without one unpleasant remark or a dissenting vote, the following appropriations were made to the College:

Women's Building	$83,000 00
Heating and furnishing the same	12,000 00
Dairy Building	15,000 00
Replacing Heating Apparatus in Williams and Wells Halls	2,500 00
Farm Barn	4,000 00
Repairs of Buildings	10,000 00
Student Labor	5,000 00
Fire Escapes	500 00

Summary of students in attendance during this year.

	Agrl.	Mech'l.	Women's.	Totals.
Graduate Students				5
Class of '99	19	8	3	30
Class of '00	14	20	7	41
Class of '01	65	50	18	133
Class of '02	97	83	45	225
Specials	10	4	20	34
Total	205	165	93	468

Special short courses: Fruit, 7; cheese, 13; creamery, 22; farm dairy, 6; stock, 23. Total short course, 71.

Total number of students, 534.

Number of students entering this year, not including those in special courses.

	Male.	Female.	Total.
Number entering	187	59	246
Average age	19-11m	23-1m	
Median age	19-5m	19 9m	
SCHOOLS PREVIOUSLY ATTENDED:			
High school	109	38	147
District	24	7	31
College	18	6	24
Private	8	1	9
Graded	25	5	30
HOW ADMITTED:			
High school diploma	50	25	75
Teacher's certificate	24	7	31
Examined	52	16	68
Standing from colleges	8	2	10
Eighth grade diplomas	9	3	12
Age	39	6	45
SUPPORT WHILE HERE:			
Father	98	44	142
Self	63	11	74
Father and self	24	1	25
PROPOSED OCCUPATION AFTER LEAVING COLLEGE:			
Farming	34		34
Mechanical engineering	36		36
Electrical engineering	16		16
Teaching	7	15	22
Merchant	1		1
Dentist	1		1
Housewife		1	1
Civil engineering	2		2
Law	3		3
Druggist	2		2
Ministry	1	1	2
Assayer	1		1
Mining engineer	1		1
Housekeeper		1	1
Uncertain	79	39	118
OCCUPATION OF FATHER:			
Farmer	83	25	108
Merchant	14	5	19
Physician	6	1	7
Deceased	12		12
Laborer	3	1	4
Plumber	2		2
Bookkeeper	1	2	3
Manufacturer	4	3	7
Preacher	1	3	4
Real estate	1	1	2
Clerk	2	2	4
Saloon	1		1
Banker	1	1	2
Railroad	4		4
Druggist	1	1	2
Lawyer	4	2	6
Insurance	1	1	2
Civil engineer	1		1
Patrolman	1		1
Harness maker	1		1
Retired merchant	2	1	3
Restaurant	1		2
Machinist	1		1
Miller	4		4
Mail carrier		1	1

	Male.	Female.	Total.
OCCUPATION OF FATHER.—*Continued.*			
Lumberman	4		4
Contractor	2		2
Mechanic	6	1	7
Artist		1	1
Electrician	1		1
Stereotyper		1	1
Building and loan		1	1
Organ tuner	1		1
Blacksmith	3	1	4
Hotel keeper	1	2	3
Tanner	1		1
Veterinary surgeon	1		1
Draughtsman	1		1
Surveyor	1		1
Express messenger	1		1
Editor	1		1
Vessel owner	1		1
Mason	1	1	2
Dentist	1		1
Electro plater	1		1
Baker	1		1
Silversmith	1		1
Justice	1		1
Barber	1		1

Counties represented in last freshman class.

Alcona	2	Kalkaska	1
Alger	1	Kent	9
Allegan	5	Lapeer	5
Alpena	1	Leelanau	2
Antrim	1	Lenawee	6
Barry	3	Macomb	1
Bay	5	Marquette	2
Benzie	3	Mecosta	1
Berrien	5	Monroe	1
Branch	2	Montcalm	6
Calhoun	6	Montmorency	4
Cass	3	Muskegon	1
Charlevoix	1	Newaygo	1
Cheboygan	1	Oakland	11
Clinton	6	Oceana	2
Crawford	1	Oscoda	1
Eaton	9	Otsego	2
Emmet	3	Ottawa	5
Genesee	6	Saginaw	2
Grand Traverse	1	Sanilac	3
Gratiot	2	Shiawassee	2
Hillsdale	3	St. Clair	4
Huron	2	St. Joseph	7
Ingham	37	Tuscola	1
Ionia	9	Van Buren	2
Isabella	6	Washtenaw	6
Jackson	8	Wayne	10
Wisconsin	4	New York	1
Ohio	1	England	1
Illinois	1	Bulgaria	1
Texas	1	Turkey	1

Other information concerning the College may be found in the various department reports in the following pages.

Respectfully submitted,
J. L. SNYDER.
President.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE DEPARTMENT OF PRACTICAL AGRICULTURE.

To the President:

SIR—I have the honor to submit herewith the annual report of the Department of Practical Agriculture, for the year ending June 30, 1899.

CLASS INSTRUCTION.

No change in the teaching force in this department is to be recorded except the departure of Mr. M. W. Fulton, after the close of the fall term, 1898. Mr. Fulton has been connected with the department since September, 1895. To his hands have been committed for the last year and more the immediate supervision of the student labor and the instruction and experiments in soil physics. He has performed his work faithfully and skillfully, and his departure is a distinct loss to the institution.

In my annual report for the year ending June 30, 1898, I presented a somewhat extended list of examination questions used in the classes in Practical Agriculture, in that year. The work of the past year has not differed materially from that of the year preceding. Our classes have been large beyond precedent in the history of the College. As a consequence we have had to divide and subdivide into sections that we could handle in the kind of work that we have given them.

In the fall term of 1898 the Freshmen were instructed in stock breeding and breeds of live stock, Prof. Mumford being assisted in the instruction in the yards by Mr. True. The large class is divided into two sections; one coming from ten to twelve a. m., and the other from one to three p. m. As winter approached the necessity of a suitable amphitheater in which to comfortably house the classes while judging the animals became more and more imperative.

While the Freshmen were taking this work in stock judging the Sophomores were completing their work in drainage, soil physics and farm crops. It was quite impossible to teach classes as large as those coming to the College last year much of the art of farming. The time of the students was therefore largely occupied with a study of general principles and the application of the sciences taught in the College laboratories to the solution of the present problems confronting farmers.

The technical work in stock feeding and management is given in the Junior year with an opportunity to carry it farther in the Senior year. In the winter and spring terms of the Junior year we have given those students who have elected for the remainder of their course, work in this department, advanced work in the chemistry of soils and fertilizers. This instruction has consisted partly of a course of reading, but mostly of actual experiments involving the analyses of soils and fertilizers. I am glad to report that, through the coöperation of the Chemical Department the students have obtained a very clear idea of proper methods of farm work to prevent the loss of fertilizing material, and to prevent at the same time the loss of moisture by evaporation.

To the Seniors who elected, there has been given a course in the chemistry of sugar making in a beet sugar factory, and a second course in the management of beet fields to grow economically the largest tonnage of rich beets under varying conditions of soil and exposure.

In general the plan adopted and followed last year in the class room work and student labor has been carried out in the year just closed.

FARM CROPS.

Below is given the distribution of the crops in the different fields of the College farm, a synopsis of the cost and of the amount and value of products.

Field.	Area acres.	Crop.	Seed.	Work.	Sundries.	Total cost.	Yield.	Value.
3		Experimental plots						
4		Small pasture lots						
5	12	Oats	$7 68	$68 95	$14 11	$90 74	569 bu.	$182 08
6	27.64	Wheat and sundries	12 00	165 75	33 47	199 22	209 bu. wheat 88,270 lbs. silage	150 48 110 34
7	17.07	Pasture						104 98
8	6	Beets					101,351 lbs.	126 69
8	17.66	Oats	11 52	140 28	21 77	173 57	685 bu.	219 20
9	23.78	Pasture						5 36
		Hay		79 26		79 26	95,983 lbs.	287 95
10	23.55	Pasture						94
		Hay		35 75		35 75	79,041 lbs.	237 12
11	23.95	Corn, silage	3 00	285 71		288 71	400,764 lbs.	500 95
		Pasture						15 25
12	34.5	Pasture						146 55
		Hay		29 50		29 50	46,214 lbs.	138 64
13	30	Corn	3 50	322 34		325 84	96,580 lbs. silage 1,810 bu. 59,714 lbs. stalks	120 73 271 50 59 71
		Pasture						26 43
14	6	Experim'tal plots for sheep						
	5	Exp'ntal plots with grasses						
	9.9	Rape	5 20	79 14		84 34		25 15
15	13.15	Oats	8 32	57 72	14 82	80 86	496 bu.	158 72
16	40	Wheat	49 00	171 16	32 76	252 88	743 bu.	534 97
	4.19	Hay					9,695 lbs.	21 49
18		Pasture						109 32

It may not be inopportune at this time to call the attention of yourself and your fellow members of the board to the condition of the College farm and equipment, nor shall I be accused of boasting for so doing.

Not going into the past history of the farm to any great extent, it is sufficient for the present purpose to remind you that, largely by student labor, the fences between the fields have been transformed from unsightly rail affairs to neat and well built wire structures. The improvement in the appearance of the farm as a whole produced by this change cannot be appreciated by people who had not visited the College under the old regime.

A large amount of manure is made annually by the horses and the herds of cattle and sheep. Originally the soil of the College farm was far from fertile, but the application of the manure year after year has brought it up to a state of fertility far above the average. At present there is growing a heavy crop of clover, notwithstanding the fact that over the southern peninsula as a whole the clover crop is well nigh a failure. The wheat crop is also exceedingly promising, notwithstanding the extreme cold weather of last winter.

The chief function of the College farm is to afford a laboratory for the Farm Department in which can be elucidated the general principles set forth in the class room. While, with our present large classes, it is impossible to teach much of the art of farming, the applied sciences may be illustrated on the broad area owned by the institution. This use of the field precludes the possibility of operating the area as a model farm. It has not prevented, however, carrying forward the farm work in a thoroughly skillful and practical way. The financial results obtained in the last two or three years, combined with the present high state of cultivation, neatness and tidy appearance of the farm, demonstrate this proposition.

Prior to 1894 and 1895 the history of the College cattle had not been illuminated by exceptional records. Thanks to the skill of the herdsman, combined with common sense and experience in the office, records were made in those years which drew the attention of dairymen and stock raisers the country over to the College. Since that time the high standard of the herd as a whole has been maintained, and the board may be justly proud of the representative animals at present constituting the herds and flocks in the College barns.

Respectfully submitted,
C. D. SMITH,
Professor of Agriculture.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President:

SIR—I have the honor to report the following work of this department for the past season:

The classroom instruction has been along lines similar to those covered in former years. During the fall term instruction in pomology was given to the Juniors of the agricultural and women's courses. The subject was treated both from the standpoint of the commercial fruit grower and of those growing fruit for home use. The propagation of fruit trees of different kinds and the planting and care of the orchard, as well as treatment of the different diseases to which they are subject, were considered.

Aside from the class room instruction, two afternoons of each week were given up to a study of the varieties of the different fruits and the characteristics of the species to which our cultivated varieties belong. Practical work was also given in the matter of budding and other operations of the nursery and orchard that are performed during the fall months. In the winter term attention was given to floriculture and winter vegetable gardening. The matter of building and heating greenhouses of different kinds was considered, as well as the method of propagating and growing the more important plants of commercial florists, as well as those more commonly grown in the window garden. The handling of the leading vegetable crops under glass also received attention. The members of the class spent two afternoons of each week in practical work in the greenhouses. They thus learned the methods of making cuttings of different kinds, potting and repotting, filling window boxes and similar work, and also became familiar with all of the common plants and their requirements.

During the first five weeks of the spring term, the subject of vegetable gardening was taken up by the Sophomores, the instruction covering the more important points in kitchen, market, and truck gardening and including the making of forcing houses, hot beds and cold frames, the selection and preparation of the soil, the application of manures and fertilizers, drainage, irrigation and the growing of all the leading crops.

Heretofore the Sophomores have taken up the subject of landscape gardening during the last half of the spring term, but in order that they might first have "Trees and Shrubs," the places of the two subjects in the curriculum were transposed, and hereafter landscape gardening will come during the last half of the spring term of the Junior year.

STUDENT LABOR.

As has heretofore been the custom the Sophomores, during the spring term and the Juniors in the fall term following, have spent two and one-half hours each day at manual labor, except when engaged in the laboratory or educational work mentioned above. During the fall term it consists of the regular work of the department, such as harvesting the various fruit and vegetable crops, and in the ordinary work of the garden and greenhouses. In the spring term a large amount of time was spent in pruning, grafting and other work in the orchard and nurseries, the transplanting of trees and small fruits, and starting various vegetable crops. A large amount of work upon the grounds, and nearly all of the work of the greenhouses has also been done by the students.

Aside from the required student labor, quite a number of students have put in extra time, especially upon Saturdays, and as many as forty students were employed from five to ten hours each Saturday, during the early part of the spring term, in cleaning up the drives, grounds, and shrubbery, and in the work of the gardens and orchards. The work that is purely educational and without value to the department is not paid for, but an endeavor has been made to have the work as practical as possible, and most of the required labor has been paid for at a maximum rate of eight cents per hour, while for extra labor the maximum has been ten cents an hour. In the summer a large number of the students remain at the College and the greater part of the work of the department is performed by them.

COLLEGE ORCHARDS.

During the summer and fall of 1898 good crops were obtained from the bearing trees in the plum, cherry, and pear orchards, and a fair crop of grapes was produced in the vineyards. The apple orchards, however, gave but a small crop and much of the fruit was of an inferior nature.

THE GROUNDS.

Except for two short periods during the summer, the rainfall was sufficient to keep the lawns in a fresh, green condition, and on these occasions we were able to supply water to a considerable portion about the buildings, so that the grass did not suffer as seriously from drouth as in previous years, and as a consequence the turf is much more close and velvety than ever before.

The opening up of the College Delta made a walk in that direction a necessity, and during the fall a cement walk was constructed from the residence of the Professor of Mechanical Engineering in a northwesterly direction to the Delta, and branch walks were built from this to the house occupied by Professor Pettit.

In the fall permission was secured from the Board of Agriculture to fence in the "wood lot" and a part of the arboretum adjoining for a deer park. It was enclosed with a Page woven wire fence seven and one-half feet high, and a small pond was excavated and water provided from the College system. A pair of young elk and three deer, buck, doe, and fawn, were procured from Belle Isle park, Detroit, through the kindness of the Detroit Board of Park Commissioners.

THE WATER GARDEN.

In the early days of the College there was a small tamarack swamp north of where the Horticultural Laboratory is now located. It was in a depression, and although underdrained, it was frequently filled with water that run in from the lawns, and crops were frequently injured in consequence. It was also very frosty and only the more hardy and late vegetables could be grown with success. As a result of this the land was of little value for gardening purposes and it was thought best to utilize it for a water garden. In September, 1898, the muck was scraped out so as to form a lake of about one-half acre. The bottom being hardpan, it holds water with but little loss from seepage, and except for a few weeks during the summer a supply can be maintained from the large drain which crosses the grounds, while the irrigating system can be used if necessary. The banks of the lake were arranged in irregular lines and an island was constructed in the center to which bridges leading from either side were built. During the past spring, the banks of the lake have been planted with shrubbery, and a large number of sub-tropical and other herbaceous plants have been used. The water is maintained at a depth of from one to two feet and a double line of aquatic plants have been placed along the banks. The species used included many of the more common *Nymphaeas* (Water Lilies), and *Nelumbiums* (Egyptian or Chinese Lotus), as well as a large number of tender lilies and other aquatics.

As the water level is not more than two feet below the level of the banks, the soil will be moist throughout the season and the plants should make a luxuriant growth.

THE GREEN HOUSES.

Few changes have been made in the conservatories, except in the heaters and in the arrangement of the pipes connecting with the heating coils. When the houses were first erected all of the pipes were placed beneath the benches, but nearly every winter, and during the past season in particular, trouble has been experienced from the formation of ice upon the plates of the houses, which has broken the lower row of glass on the roof. By changing the pipes so that the flows will be just beneath the plates, it is hoped that this trouble will be obviated.

Aside from their use in furnishing practical instruction in floriculture and winter vegetable gardening, the greenhouses supply plants for decoration of the grounds and for the various functions. No attempt has been made to grow plants or flowers for sale, although where a crop has been grown and has served its purpose any surplus is disposed of to the best advantage possible. In order that we might not compete with the Lansing florists, a large part of the surplus plants and flowers have been sold to them at wholesale prices, and this arrangement has given mutual satisfaction. As in previous years during the sessions of the legislature, a supply of flowers has been sent to the State capitol two or three times each week, for the executive parlors and legislative chambers. The greenhouses have been in charge of Mr. Thomas Gunson, who has handled them in a very satisfactory manner, and the plants generally have been in a healthy condition, and the houses have served their purpose to a good advantage.

SPECIAL SHORT COURSES.

As in previous years arrangements were made for offering instruction in two special lines for six weeks during the winter of 1898-9. The special course in fruit culture covered much the same grounds as was given to the Juniors in the fall, and, in connection with it, instruction in entomology, botany and chemistry was also provided. The students in the special course in floriculture and winter vegetable gardening formed a part of the regular class in this subject and also received instruction in the sciences mentioned above. Practical work in greenhouse methods, and in such of the operations of fruit culture as could be given during the winter were also provided.

INSTITUTES AND MEETINGS ATTENDED.

During the year I have attended one-day institutes at Arcadia, Fremont, Borland and Reed City. I also attended the Long Fruit Institute at Fennville and the Round-up at Pontiac. Messrs. Gladden and Dean, of the Horticultural Department of the Experiment Station, have also given two weeks each to institute work.

During the season I attended a number of meetings of county horticultural societies, and in December I was invited to read a paper upon "The Construction and Use of Greenhouses" before the Missouri State Horticultural Society. The meeting was held at Columbia, the seat of the State University and Agricultural College, and one afternoon was devoted to inspecting their equipment. The meeting was well attended and I was much pleased to be able to renew my acquaintance with the old and meet the new, members of the society and of the university faculty. In June, 1899, I attended the meeting of the American Association of Nurserymen at Chicago and read a paper upon the "State Control of Dangerous Insects and Diseases."

In March, H. P. Gladden was appointed assistant professor in the department, but resigned to take effect July 1, and U. P. Hedrick was elected to succeed him.

L. R. TAFT,
Professor of Horticulture and Landscape Gardening.

Agricultural College, Mich.,
June 30, 1899.

DEPARTMENT OF CHEMISTRY.

Prest. J. L. Snyder:

Sir—The following report of the Chemical Department for the year ending June 30, 1899, is respectfully submitted.

As in former years the year just closed has been one of active work and lively interest both in the class room and laboratory; also in work for the agricultural public. By reason of the changes in the course of study to facilitate instruction in other departments, some of the work was duplicated, and the tax on the energies of the teachers increased thereby.

The following scheme of studies and hours for lectures and laboratory work for the three courses of study gives some idea of the amount of work required for the three terms of the year 1898.

In this scheme Ag. signifies the Agricultural Course, M. the Mechanical Course, and W. the Women's Course. The h. preceded by figures represents the number of hours a week given to any study for the term.

FALL TERM, 1898.

Sophomores	Ag.	Analytical chemistry	10 h.
	W.	Analytical chemistry	10 h.
Juniors	Ag.	Volumetric analysis	2 h.
	W.	Volumetric analysis	2 h.
	Ag.	Organic chemistry	5 h.
	W.	Organic chemistry	5 h.
Seniors	Ag.	Meteorology	5 h.

WINTER TERM, 1899.

Sophomores	Ag.	Organic chemistry	5 h.
	W.	Organic chemistry	5 h.
	M.	Elementary chemistry	6 h.
	M.	Chemical laboratory	2 h.
Juniors	Ag.	Agricultural chemistry	5 h.
Seniors	Ag.	Quantitative chemical analysis	10 h.

SPRING TERM, 1899.

Freshmen	Ag.	Elementary chemistry	5 h.
	Ag.	Chemical laboratory	2 h.
	W.	Elementary chemistry	5 h.
	W.	Chemical laboratory	2 h.
Sophomores	M.	Elementary chemistry	6 h.

In addition to the regular class work as here detailed, instruction was given to students of the short course in the winter by lectures and laboratory practice for the classes in the Dairy Course and Fruit Course. In this way I gave three lectures a day for a few weeks to as many classes.

SUGAR BEETS.

Much time and labor were given to the sugar beets as related to the agricultural and manufacturing industries of the State. In the Round-up Farmers' Institute at the College in February, 1898, the subject was presented in a lecture with illustrations and charts.

ADULTERATION OF WHEAT FLOUR.

The Chemical Department has taken a lively interest in the wheat crop of this State by the selection of new and better varieties of wheat for the use of our farmers. It has not been indifferent to processes of adulteration of wheat flour as practiced in some parts of our country. The grinding and shipment of train loads of inert rock ("Mineraline") in Greensboro, N. C., to adulterate flour for human food and feeding stuffs for animals have not passed unnoticed. But the widespread practice of adulterating wheat flour with products of Indian corn, which at one time threatened to drive out the honest miller and even destroy our foreign trade in flour, attracted the special attention of this department. A letter from W. A. Coombs of Coldwater, in March, 1898, showed the pecuniary temptation for the miller to engage in this disreputable business. Mr. Coombs wrote: "A miller told me that he run in 270 barrels of corn flour into his flour daily, and at a profit of $2.50 for each barrel of corn meal"—or a clear cash profit of $675 a day for being a rascal! A Chicago firm was sending out to the millers of the country circulars to show the large profit in "blending corn products with wheat flour" and sending specimens of "Flourine" and "Corn Flour" to be used for degrading this best gift of a bountiful Providence for the use of man. Samples of these adulterants were secured and analyzed, and the "Flourine" found to be corn starch, and "Corn Flour" a finely-ground meal made from white corn, or common corn bleached by sulphurous acid.

A barrel of this "blended flour" was obtained from Louisville, Ky., and another from Nashville, Tenn., to test the bread-making and nutritive value of such material in comparison with a low grade flour made in Michigan. Specimens of these flours were put up in paper sacks, numbered 1, 2 and 3, and were placed in the hands of expert bread makers at the College and in the city to test the doughing quality of each kind, how it responded to the action of yeast and how it behaved in the oven. The report of these experts was unanimous that No. 2 (third-class Michigan flour) was better than Nos. 1 and 3 (Kentucky and Tennessee flours). A jury of food experts at the College consisting of the wives of the professors and ladies in the Women's Department, with the help of some of the professors, then considered the quality of the bread made from these flours. The verdict was again in favor of a third-class Michigan flour in preference to the "blended flours."

I was glad to learn that out of the large number of Michigan millers, only one turned into the broad and easy Chicago path leading to dishonest wealth, and he soon returned to straight paths.

Out of the dark cloud of the Spanish war came forth a blessing alike to farmer, miller and bread eater in "the Tawney bill," which required a license to be taken by the miller who thus adulterated his flour, and a government stamp to be placed on every barrel of such flour offered for sale. When a package of flour bore this "mark of Cain" on its face, the sale of the mixture as pure wheat flour was prevented.

A BUREAU OF INFORMATION.

If all the letters asking for information and specimens for analysis that come to this department in a year were preserved and properly mounted, there would be a volume of "Curiosities of Literature" outranking D' Israeli, and a cabinet of curiosities to awaken wonder. Many persons do not realize how much they are asking in making such inquiries or sending samples for analysis. A postal card came to me from Saugatuck containing 143 questions. To answer all of them would require the work of an expert for a whole month. Possibly the man felt he had squandered a cent in buying the postal card to propound questions to which he received no reply. Another man will send a handful of soil for analysis, asking for report of the analysis by return mail, not realizing that such analysis would require several days of careful work and would probably be of no value to the public, but only gratify the curiosity of one person.

Some persons seem to get the notion that the College chemist is here for the most part to do these miscellaneous jobs, and they have the right to demand such work of him. They do not realize that *the work of the Chemical Department is to teach the classes in chemistry, and to make investigations that will be of value to the public.*

In the future as in the past, letters asking for information, and specimens for examination, will receive such attention as will not interfere with the regular duties of the department, but the claims of the College on our time and effort in the line of instruction and experimental work for the public will be first and supreme.

METEOROLOGICAL OBSERVATIONS.

Meteorological observations have been carried on at the College since April, 1863. The same were continued through 1898. This is the longest systematic series of such observations ever made in this State. The value of such observations increases with the number of years.

Respectfully submitted,
R. C. KEDZIE,
Professor of Chemistry.
F. S. KEDZIE,
Adjunct Professor of Chemistry.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE MECHANICAL DEPARTMENT.

To the President:

SIR—I have the honor of submitting the following report of the work done in the Mechanical Department during the year ending June 30, 1899.

The work in the class rooms, drawing rooms, etc., has been conducted as follows:

FALL TERM.

Seniors.—Thermodynamics by Prof. Weil. Experimental Laboratory by Prof. Weil and Mr. Smith. Steam Engine Design, Graphical Statics of Mechanism and Elementary Kinematics by Mr. Westcott. Shop Practice by Mr. Leonard.

Juniors.—Machine Design by Mr. Smith. Metallurgy by Prof. Neil.

Sophomores.—Shop Methods by Mr. Leonard. Shop Practice by Messrs. Leonard, Theadore and Baker.

Freshmen.—Shop Practice by Messrs. Bradford and Baker.

WINTER TERM.

Seniors.—Advanced Kinematics by Prof. Weil. Steam Engineering Laboratory by Prof. Weil and Mr. Smith. Advanced Machine Design by Mr. Leonard.

Juniors.—Machine Design, Steam Engine Design and Valve Gears by Mr. Wescott. Boilers by Prof. Weil. Shop Practice by Mr. Leonard.

Sophomores.—Elements of Machine Design by Mr. Smith. Shop Practice by Messrs. Leonard, Theodore and Baker.

Freshmen.—Shop Practice by Messrs. Bradford, Baker and Newman.

SPRING TERM.

Seniors.—Engineering Practice, Original Design and Thesis Work by Prof. Weil.

Juniors.—Strength of Materials and Testing Materials of Engineering by Mr. Westcott. Shop Practice by Mr. Leonard.

Sophomores.—Elements of Machine Design and Elements of Steam Engine by Mr. Smith. Shop Practice by Messrs. Leonard, Theadore and Baker.

Freshmen.—Shop Practice by Messrs. Bradford, Baker and Newman.

No changes of importance were made during the year in the regular studies or in the apportionment of work among the instructors. I would call attention to the fact, however, that Mr. Newman—as was the case last year—devoted the greater part of his time to the work of instructor in the Drawing Department.

During the past year we have completed, in our shops, a ten-inch turning lathe—making nine lathes of this type now completed in the department—a "rattler" for the foundry, a key-seating attachment for planer, an extension head for planer, also a number of small tools and appliances. We have also completed a considerable amount of work for a milling-machine now being built in our shops—including a number of important patterns. As usual, considerable work has been done in the shops during the year in the way of repairs.

The expenditures in this department for equipment—outside of amount expended for new lathe—have been limited. We have purchased six lathe chucks, five high grade thermometers, a number of small tools, such as hammers, turning chisels, etc., a Bath indicator, a combination vise, a Buffalo scale, a few drawing instruments and books, and several pieces of apparatus for use in connection with the testing of cements, cement grips, cement scale, test wires, etc. The foregoing list covers practically all the purchases for equipment outside of a sixteenth-inch Lodge & Shipley engine lathe that was purchased this June.

Among the more important work undertaken in this department during the year—outside of regular work—may be mentioned the following:

(a) An extensive series of tests of cements for the City of Detroit, performed under the immediate supervision of Mr. Westcott.

(b) Plates and notes on machine design for the use of several classes, prepared under the direction of Mr. Wescott and Prof. Weil.

(c) Floor plans of Wells Hall and Williams Hall, drawn by Mr. Newman, assisted by Mr. Smith.

(d) Plans for underground heating mains and for heating systems in dormitories by Prof. Weil.

The mechanical laboratory has been improved during the past year by painting the exterior brick work and roof and the laying of new floor in offices; these improvements are much appreciated in the department.

Because of the large attendance at the school, we are obliged to devote the greater part of the money apportioned to this department to paying for labor and purchasing stock. It would seem necessary that in the near future some provision be made for the purchase of machine tools and experimental apparatus needed for the successful carrying on of the work demanded by our increasing classes.

Respectfully submitted,
CHAS. L. WEIL,
Professor of Mechanical Engineering.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE DEPARTMENT OF BOTANY AND FORESTRY.

To the President:

SIR—I hand you my report for the year closing June 30, 1899.

During the year students have received instruction in this department as follows:

Resident graduate, two terms	1
Seniors in preparing theses, twelve weeks	7
Seniors, agricultural in grasses, daily four weeks	2
Juniors, agricultural in parasitic fungi, daily fourteen weeks	13
Juniors, agricultural in systematic botany, three times a week for ten weeks	8
Juniors, agricultural in forestry, daily six weeks	18
Juniors, agricultural in weeds, daily four weeks	11
Juniors, agricultural and women in trees and shrubs, daily five weeks	21
Sophomores, agricultural and women in trees and shrubs, daily five weeks	68
Sophomores, agricultural in plant histology, daily twelve weeks	59
Sophomores, women in plant histology, three times a week for ten weeks	15
Freshmen, agricultural and women in structural botany, daily fourteen weeks	135

Freshmen, agricultural and women in structural botany, daily four weeks	114
Special course in horticulture, daily six weeks	8
Special course in live stock, twice a week for six weeks	18
Special course for Seniors in sugar beets for four weeks	8
	506

This is exactly twice the number taught in 1894.

THE HERBARIUM.

At considerable extra labor of those employed in the department, we have made more exchanges than usual. For some years past we have been giving more attention to collecting the plants in different portions of our own State. The additions for the year have been as follows:

SEED-PLANTS, FERNS AND THEIR ALLIES.

W. J. Beal collected south of Marshall, Calhoun county	140
N. M. Glatfelter, hybrid willows	70
C. G. Pringle, Mexican plants	160
O. D. Allen, plants from the state of Washington	105
Baker, Earle and Tracy, grasses from Colorado	100
S. M. Tracy, plants from Mississippi	726
C. R. Ball, grasses and sedges from Iowa	62
I. M. Bates	2
C. S. Crandall, plants from Colorado	878
C. F. Wheeler, plants from Grayling	15
V. H. Chase, plants from Illinois	570
S. P. Orth, by way of botanical club, plants from Labrador	50
H. E. Brown, plants from California	17
F. H. Hillman, grasses from Nevada	2
C. D. McLouth, plants from Muskegon	203
Collections made at M. A. C., mostly by C. F. Wheeler	68
One set trees and shrubs of Michigan, not complete	175
	3,343

Fungi.

Seymour and Earle	40
Arthur and Holloway	55
A. B. Seymour	51
C. S. Crandall, parasites	156
Home collections	42
	394

Lichens.

Cummings, Williams and Seymour	30

Algæ.

Collins, Holden and Setchel, fascs. IX, X, XI, XII	200
Josephine E. Tilden, Fasc. III	100
	300
Total addition for the year closing June 30, 1899	4,067

GENERAL SUMMARY OF PLANTS IN THE HERBARIUM.

Seed-plants (Spermatophyta)	54,326
Ferns and their allies (Pteridophyta)	1,130
Mosses and Liverworts	1,867
Lichens	1,135
Fungi	9,444
Algæ	1,045
Total number in the herbarium	68,947

THE BOTANIC GARDEN.

This has fully maintained its number of species and general appearance.

A persistent effort has been made to gather in everything of any promise in the State and give it a place in the garden. Instead of soliciting gifts of seeds and plants or buying them at random, a long list has been prepared at much cost of time. This list was compiled from notes made on reading *Garden and Forest* and some other journals. Valuable additions to the list were also made by the writer last summer during his visit to the Botanic Graden of Harvard University, the Arnold Arboretum and the New York Botanic Garden.

From this list of choice plants we now make selections for our garden and gradually discard some of those of less value.

Although the garden last winter was better mulched than usual with manure and marsh hay, the losses were never before so heavy. This was owing to the severe cold for two or three weeks, when there was very little snow on the ground.

THE ARBORETUM AND THE WOODS OF THE COLLEGE

have made little change during the past year. The woods have been considerably thinned by cutting out beeches which began to decay after the severe dry weather of 1894 and 1895.

DONATIONS.

From J. D. Tower: Rootstock of June grass piercing root of sassafras.

From S. Alexander, Birmingham, Mich.: Four lots of foliage and fruit of oaks.

From W. A. Kellerman, Columbus, Ohio: Living plant of Helianthus.

From Geo. E. Allam: Plants and seeds of *Linaria Macedonica* and *Linaria purpurea.*

From Arnold Arboretum, Jamaica Plain, Mass.: 52 kinds of living plants.

From Botanic Garden of Harvard University, Mass.: 73 kinds of living plants.

From Botanic Garden of Smith College, Mass.: 21 kinds of seeds.

From Royal Gardens, Kew, England: 103 kinds of seeds.

From C. L. Whitney, Traverse City: Living plants of shamrock.

From Botanical Club of M. A. C.: 50 plants from Labrador, collected by S. P. Orth.

From J. J. Hubbell, Manistee; 10 blocks of second-growth timber; 13 photographs of timber and stump lands.

GIFTS TO OTHERS.

To the Gray Herbarium, Harvard University....................	375
To U. S. Dept. of Agriculture Herbarium specimens of wheat......	45
To Colorado Agricultural College, by way of exchange and more...	1,494
To State University, living plants...............................	13

I again tender my thanks to Prof. C. F. Wheeler and Instructor B. O. Longyear for valuable assistance.

I am yours truly,
W. J. BEAL,
Professor of Botany and Forestry.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND CIVIL ENGINEERING.

To the President:

Sir—In common with other departments we have felt the stress of work incident to the largely increased attendance at the College. In no earlier year have the capacity of class rooms and the energies of teachers been so nearly overtaxed. But it is a pleasure to make a record of work successfully accomplished and of results satisfactory in general.

The unprecedented increase in total class enrollment, more than double that of two years ago, necessitated a permanent addition to our teaching force, and Mr. Frank V. Warren was engaged as instructor. He has shown himself in every way qualified for the position and has done his full share of the year's work. Assistant Professor W. Babcock and Instructor W. O. Beal have continued in their respective positions and have answered cheerfully and efficiently all demands made upon them. It may be noted that ten years ago, when the aggregate class attendance in mathematics was scarcely a third as large as now, three teachers were provided; and the number was not increased until last year. A study of the schedule and a little arithmetic will show that if next year's entering class shall be larger than the present freshman class we shall hardly be able to meet the classes assigned to us unless another instructor in available.

INSTRUCTION.

The amount of class work, its division in the different terms of the year and the assignments of teachers are shown in the schedule which follows:

Fall term, 1898. Seniors, one class in graphic statics, Professor Vedder; one class in civil engineering, Professor Vedder. Juniors, one class in surveying, Professor Vedder; one class in integral calculus, Assistant Professor Babcock. Sophomores, two classes in trigonometry, Professor Vedder and Mr. Beal; three classes in solid geometry, Assistant Professor Babcock, Mr. Beal and Mr. Warren. Freshmen, six classes in algebra; two for mechanical students commencing with the subject of quadratics, Assistant Professor Babcock and Mr. Beal, and four for women and agricultural students, beginning the study of algebra, one section each in charge of Assistant Professor Babcock and Mr. Beal, and two sections in charge of Mr. Warren. Total enrollment in all regular classes of the Fall term, 397.

Winter term, 1899. Seniors, one class in agricultural engineering, Professor Vedder. Juniors, one class in mechanics of engineering, Professor Vedder. Sophomores, two classes in analytic geometry, Assistant Professor Babcock. Freshmen, two classes in plane geometry, Assistant Professor Babcock and Mr. Warren; two classes in second algebra for mechanical students, Assistant Professor Babcock and Mr. Beal; and four classes in second algebra for women and agricultural students, two sections each in charge of Mr. Beal and Mr. Warren. Total enrollment for the term, 341.

Spring term, 1899. Seniors, one class in civil engineering, Professor Vedder. Juniors, one class in mechanics of engineering, Professor Vedder. Sophomores, one class in surveying, Professor Vedder. This class had to be divided into two sections for field work, in the direction of which all teachers of the department assisted. Two classes in plane trigonometry, Professor Vedder and Mr. Beal; and one class in differential calculus, Assistant Professor Babcock. Freshmen, two classes in solid geometry, Assistant Professor Babcock and Mr. Warren; and four classes in plane geometry, two in charge of Mr. Beal and one each in charge of Assistant Professor Babcock and Mr. Warren. Total enrollment for the term, 319.

During the year 88 special examinations have been given and reported, and 150 entrance examination papers have been read.

As in former years, I have made a table which shows the totals of the above class record, and some other points that may be called in question.

Class work of the department of mathematics and civil engineering for the college year 1898–99.

Class.	Subject.	Term.	No. of divisions	No. of hours per week for each division.	Total No. of hours per week for the class.	No. of students enrolled.
Freshmen	Algebra	Fall	6	5	30	201
"	"	Winter	6	5	30	208
"	Geometry	"	2	5	10	68
"	"	Spring	6	5	30	174
Sophomores	"	Fall	3	5	15	79
"	Trigonometry	"	2	5	10	56
"	Analytic geometry	Winter	2	5	10	45
"	Pl. trigonometry	Spring	2	3	6	47
"	Surveying (class)	"	1	2	2	43
"	" (field)	"	2	2	4	
"	Dif. calculus	"	1	5	5	33
Juniors	Surveying	Fall	1	4	4	25
"	Int. calculus	"	1	5	5	19
"	Mechanics	Winter	1	5	5	15
"	"	Spring	1	5	5	13
Seniors	Civil engineering	Fall	1	9	9	9
"	Graphics	"	1	3	3	8
"	Agr'l engineering	Winter	1	5	5	5
"	Civil engineering	Spring	1	7	7	9
Totals			41		195	1,057

Our classes have used as text-books the following:

Van Velzer & Slichter's School Algebra for women and agricultural students, Van Velzer & Slichter's University Algebra for mechanical students, Wentworth's Geometry, Jones' Trigonometry, Tanner & Allen's Analytic Geometry, Rice & Johnson's Calculus for the Fall term class, Taylor's Calculus for the Spring term class, Church's Mechanics, Hodgman's Manual of Land Surveying, Merriman & Jacoby's Graphic Statics and Johnson's Theory and Practice of Surveying. Of course, frequent reference is made to other texts, and in no case is the course of instruction based solely on the text- book used. In some classes no text is required.

Some time during the year I prepared at your request a statement of the kinds of work actually undertaken by the members of our teaching force in regular prosecution of their duties. Part of that statement consisted of a list which I would like to insert here as showing that the amount of work falling to this department cannot be determined by the scheduled number of hours in class room:

1. Instruction in class room.
2. Study of subject and manner of presentation.
3. Arrangement of instruments for class illustration and return of the same to their places after use.
4. Preparation of problems and drawings before class.
5. Reading and marking of written work submitted by classes.
6. Special examinations for entrance, to make up back work, and for advanced standing.
7. Direction of thesis work.
8. Reports to President of results of work.
9. Requisitions for supplies and purchase of the same.
10. Correspondence.

11. Faculty meetings and instructors' meetings.
12. Committee work on faculty committees.
13. Direction of affairs of co-operative store.
14. Adjustment and care of instrumental equipment.
15. Surveys on College premises.
16. Drawing maps of drains, sewers, steam and water lines, etc.
17. Keeping set of books and record cards.
18. Conferences with and help to individual students.
19. Examinations during last week of term.
20. Repairing instruments, making leveling rods and directing repairs in instrument room, class rooms and office.

It will be seen that assignment to duty in any class entails some work for the instructor under each of the items 1, 2, 4, 5, 8, 17, 18 and 19. If the study be a technical one, item 3 must be added. Special examinations, committee work and surveys are largely relegated to Saturdays, some committee work to the evenings. During the year, Professor Babcock gave much of his time to the affairs of the co-operative store, acting as president of the organization in charge of that institution.

EQUIPMENT.

The expenditures of the fiscal year for supplies, instruments, etc., purchased for the department aggregate $184.74. Of this amount $50 was specially apportioned and used for preparing tracings and blue-prints of maps on file in my office, which copies are intended to serve the purpose of guides for the architect, engineer and others in planning improvements about the College.

The inventory of property belonging to this department, including instrumental equipment, observatory, office and class room furniture, shows an aggregate value on June 30 of $4,039.93 against $3,974.03 for last year.

SURVEYS, ETC.

In the summer of 1898 I completed three copies of the plat of College Delta, and filed them as required by law. Then steam lines to College Hall and the chemical laboratory were staken out and graded, as were also some minor extensions of the steam lines to the botanical laboratory and the library. A system of sewers for the Delta was designed and laid out. Several other surveys of water and sewer pipe lines have been made, but none of any great importance. Besides these surveys of new work, we have done considerable mapping of old survey notes, adding new measurements when necessary.

Respectfully submitted,
H. K. VEDDER,
Professor of Mathematics and Civil Engineering.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE DEPARTMENT OF ZOÖLOGY AND PHYSIOLOGY.

To the President:

Sir—I have the honor to submit the following report of the Department of Zoölogy and Physiology for the year ending June 30, 1899.

There has been no change in the personnel of the department during the year, and the schedule of classes was as follows:

Fall term—Economic Zoölogy, Agr. Seniors, 1 section, 13 students; lectures by Prof. Barrows; laby. work by Prof. Barrows and Instructor Pettit. Physiology and Anatomy, Agr. Sophomores, lectures and laby. (3 sects.), 63 students. Physiology and Anatomy, Women Sophomores, lectures and laby. (2 sects.), 16 students.

Winter term—Geology, Agr. Seniors,1 sect., 8 students, Prof. Barrows. Physiology and anatomy (2d term), Agr. Sophomores, 5 sections, 54 students, Prof. Barrows, Instructor Pettit.

Physiology and Anatomy (2d/term), Women Sophomores, 1 section, 11 students, Barrows and Pettit.

Entomology, Special Short Course, 1 sect., 6 students, Instructor Pettit.

Spring term—Entomology, Agr. Seniors, 1 sect., 5 students, Barrows or Pettit.

Entomology, Agr. Sophomores, 4 sects., 47 students, Barrows and Pettit.

In addition to these regular classes, the head of the department prepared and delivered a stereopticon lecture for the annual meeting of the State Horticultural Society at Ann Arbor in December, and also made addresses at farmers' institutes at Cadillac, Wexford county; McBains, Missaukee county, and Reed City, Osceola county.

In connection with the class work scheduled above, I desire to call attention to the unfortunate position assigned to the entomology by the "new course" of study which was in operation this year for all except the senior class. The required entomology was formerly taught in the junior year, only a single term being given to this important subject, but it was followed by another term (elective) in the senior year. At the request of the horticultural and farm departments, and against my earnest protest, this junior entomology was transferred to the sophomore year, while the elective entomology was left in the senior year. The amount of entomology was little enough at best, and the two possible terms were separated by a full year, but under the present arrangement the required term and the elective term are *two years apart*, and the result naturally is disastrous. In my opinion the old schedule was much preferable to the new as it now stands, yet if it were possible to add another term of this important science (either required or elective) in the *junior year,* it would greatly strengthen the agricultural course and would make the present senior elective of double value.

Another point to which I would direct attention is the impossibility of handling satisfactorily the large classes in Physiology and Anatomy and Entomology with the present teaching force. If the work consisted solely of lectures or recitations this might be accomplished with fair results, but the very essence of the work in anatomy and entomology lies in the practical laboratory methods where the student handles, examines, sketches, identifies, and dissects actual specimens, and such work cannot be carried on to anvantage in large sections under single instructors. In former years it has been possible in the laboratory to give to each section of twelve students the undivided attention of two instructors, but during the past term two instructors were compelled to supervise the work in entomology of 24 to 28 students in a section, with the inevitable result that the work done was inferior to that of former years. In the dissection work of the second term of Physiology and Anatomy it was necessary to divide the large class into five sections in order to insure anything like thorough work, but since only one section at a time could be handled, each student was compelled to lose (or to use at a great disadvantage) four-fifths of the time allotted to laboratory work in that study. A single additional assistant would do much to obviate these difficulties, and when it is remembered that for all the work scheduled above and the additional work entailed by the care of the insect collections and those of the general museum only the time of a single professor and *one-half the time of* one assistant is available, the request for an increased force does not seem to me at all unreasonable; in fact, it should be clearly understood that the lack of such assistance means simply a positive and marked lowering of the standard of work done in Anatomy and Entomology.

At the request of the State Board of Agriculture the department, during April and May, prepared and placed in position about the College grounds a large number of nesting boxes for wild birds, with the hope that in this way several species of our most useful and desirable birds might be induced to make their summer homes with us. Forty of the single nesting-boxes, adapted for the use of bluebirds, wrens, nuthatches, chickadees, and white-breasted swallows, were placed in favorable localities and two large bird houses, one with 24 compartments and the other with 50, have been prepared for colonies of swallows or purple martins. These last two houses were finished too late to be occupied this season, but several of the smaller boxes were at once occupied by wrens, and it is hoped that others may be utilized by bluebirds for their second broods. These birds have much to contend with on the campus, bluejays and red squirrels being very numerous and aggressive, while the omnipresent English sparrow is only kept in check by continual shooting and systematic discouragement of other kinds. Fortunately the birds are almost exempt from human interference, the students and other residents of the college giving them every protection possible. A more detailed report of this experiment and its results will be published later.

WALTER B. BARROWS,
Professor of Zoölogy and Physiology.

AGRICULTURAL COLLEGE, MICH.,
July 3, 1899.

REPORT OF THE CURATOR OF THE GENERAL MUSEUM.

To the President:

SIR—I have the honor to make the following report of the condition of the General Museum for the past year:

The condition of the General Museum remains much as for the past two years, although its appearance and efficiency have been somewhat improved by various additions and changes. Large printed labels have been provided for all the larger stuffed animals and for some other conspicuous specimens, and the entire collection of invertebrates has been overhauled, rearranged, and made ready for similar labeling. The collections of mounted birds and reptiles have been rearranged, also, and partly relabeled, but lack of time and assistance has prevented the completion of this work. Very little time is available except during the summer vacation, and most of the assistant's time at that season is given necessarily to Experiment Station work.

An important change in the insect collection has been inaugurated and is being pushed as rapidly as time permits. Many of the cases having become overcrowded and rearrangement being imperative, it was decided to replace the cork lining of the "Harvard" boxes with whitewood or other blocks of uniform thickness and length but of various widths, all being multiples of a unit block. The advantages of this block system are many, but in particular it allows of the rearrangement of the entire collection, or the interpolation of any number of new specimens, without drawing any pins, and it very much facilitates uniform and accurate labeling; the cost of the blocks also is less than that of the cork formerly used. About one-half of our large collection has been placed on blocks thus far, and the remainder will be similarly treated as the several orders become too large for their present quarters. This system is now in general use among the larger and better insect collections of the United States.

The needs of the museum in the way of cases and case-room have been mentioned in previous reports, and I would only add now that the collections are increasing in size and value every year, and the demand for a new and fire-proof building becomes more and more imperative. The valuation of the cases and collections, as shown by the inventory just filed with the secretary, is $17,475.00.

Among the more important additions during the past two years, I would call attention particularly to the following:

A fine adult male Alaskan Fur-Seal (*Callorhinus*) and a pup of the same species, both from the Pribyloff Islands, Behring Sea; skins obtained through Dr. David Starr Jordan, U. S. Commissioner to the Seal Islands, and mounted by Ward.

A collection of 150 typical rocks from the U. S. Geological Survey, especially designed for teaching.

A collection of 32 mammal skins and five bird skins from Thos. L. Hankinson, class of '98; the mammals all from Ingham county and collected in connection with his thesis work for degree of B. S.

A fine adult male Mountain Goat (*Aplocerος montana*) from the Selkirk range of British Columbia. (Purchased.) One of the rarest American mammals.

A Parasitic Jaeger (Gull), from Otter Lake, Mich. The first authentic specimen ever taken in the State. (Purchased.)

Parts of two very old human skeletons from an Indian mound in Osceola county, Mich.; gift of G. F. Noggle, through S. L. Ingerson.

A series of six brain models from Wm. Fuller, M. D., Grand Rapids. (Gift.)

Following is a complete list of accessions to the Museum during the past two years—that is, from July 1, 1897, to June 30, 1899, arranged alphabetically according to the donors or persons from whom purchased.

WALTER B. BARROWS,
Curator of General Museum.

Agricultural College, Mich.,
July 3, 1899.

LIST OF ACCESSIONS TO GENERAL MUSEUM FOR THE TWO YEARS ENDING JUNE 30, 1899.

C. H. Alvord—Clay-iron concretion.

H. B. Baker, Jr.—Short eared owl.

Leonard Banghart—Three rattlesnakes. (Purchased.)

W. B. Barrows—Various local fish, batrachia, reptiles and birds; collection of marine invertebrates from Atlantic coast.

Louis Beck—Opossum, *Didelphys virginiana.* First record for Ingham county. (Purchased.)

Mrs. E. L. Blunt—Three species marine shells.

E. E. Brewster—Hoary bat, *Atalapha cinerea*, from Iron Mountain, Mich.

I. H. Butterfield—Quartzite from Virginia.

E. A. Calkins—Indian arrow-head.

C. E. Calkins—Painted tortoise, *Chrysemys marginata.*

O. P. Chapin—Screech owl, *Megascops asio.*

Leon J. Cole—Crystal of franklinite; 2 crow blackbirds—one albino; rattle snake and other reptiles; various fish.

Cole and Hankinson—Rattlesnake; young pied-billed grebe (*Podilymbus*).

Fred R. Crane—Large salamander, *Necturus.*

W. E. Curtis—Map turtle, *Malaclemmys geographicus.*

D. C. Davidson—Indian relics. (Purchased.)

M. L. Dean—Barred owl, *Syrnium nebulosum.*

A. F. DeFrenn—Striped watersnake, *Regina leberis.*

Howard Edwards—Skull of dog.

E. E. Elliot—Large turtle, *Chelydra serpentina.*

Wm. Fuller, M. D.—Set of plaster models of human brain.

O. H. Freeland, by B. O. Longyear—Large spider, *Mygale.*

L. R. Gale—Blanding's tortoise, *Emys meleagris.*

W. J. Geib—Complete cast skin of large snake, *Bascanion constrictor.*

Geological Survey of U. S.—Collection of typical rocks, 150 specimens.

T. L. Hankinson—32 mammal skins; 5 bird skins.

Dick Harrison—Mole, *Scalops*; muskrat, *Fiber zibethicus.*

M. G. Hillman—Salamander.

E. E. Howell—Minerals and crystal models. (Purchased.)

Wm. D. Hurd—Various fish.

W. J. Hutchison—Carpenter bee and burrow.

S. L. Ingerson—Mole, *Scalops;* young bittern, *Botaurus.*

David Starr Jordan, Ph. D.—Two Alaskan fur seals, *Callorhinus.*

Dr. R. C. Kedzie—Sample of beet-sugar from Bay City.

B. O. Longyear—Salamander.

C. E. Marshall—Parasite in liver of rabbit.

Milburn—Large salamander.

A. A. Morse—Frontal bone of cow with three horns.

Jason E. Nichols—Egg of Wilson's snipe, from vicinity of Lansing.

G. F. Noggle—Human bones from Indian mound in Osceola county, Mich.

Chas. M. Norton—Large salamander.

R. H. Pettit—Mole, *Scalops;* bittern, *Botaurus*; painted tortoise; map turtle; frog tadpoles; lamprey; 35 species of local shells; 3 species fresh water sponges.

E. Randolph—Horned grebe, *Colymbus auritus.*

J. M. Rankin—Skull of cotton-tail rabbit; meadow mouse; soft-shelled tortoise.

John Scott—Mole; large toad.

Percy S. Selous—Mounted mammals—wildcat, raccoon, badger, hare. (Purchased.)

V. M. Shoesmith—Flying squirrel.

F. E. Skeels—Indian sap-bucket.

H. C. Skeels—Two moles.

Robt. P. Stark—Parasitic jaeger (purchased); marsh hawk; young bats.

C. S. Strayer—Red-horse, *Moxostoma.*

H. K. Vedder—Fish.

Ward's Nat. Science Establishment—Minerals and fossils. (Purchased.)

G. A. Waterman, V. S.—Intestinal worms from colt.

Chas. F. Wheeler—Rare snake, *Tropidoclonium kirtlandii*; spotted tortoise; freshwater shells; basalt pebble from drift.

Zoölogical Laboratory—2 common rats; 2 kittens in utero.

REPORT OF THE PROFESSOR OF ENGLISH AND MODERN LANGUAGES FOR THE YEARS 1898-99.

To the President:

SIR—The work of this department for the year 1898-'99 has been carried on according to the plan entered upon some three years ago and explained in detail in previous reports.

The classes, with the exception of the one in French and the senior classes in literature, have all been large, and it has required especial effort and application to keep up the careful and minute criticism of the written work, which constitutes so essential a part of our system.

In the Fall term the Freshman class was divided into six sections, and the Sophomore into four; but to meet what seemed to be the necessities of the situation, two of these Sophomore sections had to be united into one, making a class too large for the seating capacity of my recitation room. From personal experience with this double section and with other large classes in my career as a teacher, I am very sure that, for the best work in our department, classes should not number over thirty-five. In purely lecture work, of course, the number in a class may be indefinitely enlarged without detriment; but the lecture, to be of any especial benefit, must be supplemented by laboratory work, in which the student comes into personal contact with the instructor. It is to be recollected that, in the language-work, lecture-room and laboratory are, so to speak, combined, and in the exercises of the one hour both forms of teaching must enter. Each principle formulated or enunciated must be fixed by actual practice, with the student for prime mover. Within limits, the larger the percentage of personal work in the class, the greater the benefit accruing to the student. The greatest reproach against our public school system is that through its huge, unwieldy classes it ignores and in a measure suppresses the personality of the pupil; and for immature students the inestimable advantage of the small college over the large one lies in the direct, continued, personal contact of the developing mind with the cultured intellect and heart of the teacher, leading and guiding, it is true, but according to individual bias and capability. In no branch of college work does this personal contact count for more than in the study of expression, and I would earnestly deprecate the loss of so great an advantage through over-crowded sections. The over-crowded section means a lessening of efficiency and lowering of the grade of work done, and this we cannot afford. The American manufacturer has won his preëminence in the industrial world through uniform excellence in quality of output. He knows the exact capacity of his plant and recognizes that over-crowding means either a breakdown or inferior work. When orders come beyond his capacity, he either refuses them or enlarges his plant; for, not to speak of conscience, shrewd business sense has taught him that the one thing that does not pay is to injure his reputation by poorer work. I fail to see why a school, public or private, should not be even more rigid than the factory in adhering to so obviously imperative a policy.

The matter of granting credits to high school graduates is assuming great importance, and it would be well for us to formulate some more definite rules concerning it. Our present custom is to give *all* high school graduates credit for one term of work on our course in English and also in French or German (if these languages have been embraced in the high school course pursued), and to be governed as to subsequent credits by the record the student makes at the College, either in classes or in a more or less informal examination when the student first appears at the College. In the classes it is no infrequent thing for us, finding a student well advanced in the work of his class, to advance him without request on his part; and when a request for advancement comes, it is always carefully considered, the student never being refused an opportunity to prove by examination his fitness for advancement. The examinations are untechnical, and are designed solely and simply to discover whether the student has the general knowledge and actual facility of expression commensurate with the grade of work to which he aspires. I am perfectly sure that in these examinations no student has ever been held back when subsequent developments have not demonstrated the wisdom of the course pursued. I am not so sure, on the other hand, that men have always been benefited by the advancement they have received. It should not be forgotten that in our courses the question is, not what a man has been over nor even whether he has received from a given study the usual amount of general culture and training, but always and everywhere what of the subject has he assimilated? what immediate and practical application of his knowledge can he make? The only change of policy that I can at present recommend is that a record be kept against each high school represented at the College, and that credits for any high school be increased or diminished according to the increase or diminution of efficiency shown by the records during the previous year.

I wish to have it here a matter of record that, while the department is credited with a number of assistants, only two persons (one of whom is myself) devote their entire time to the work of the department. The arrangement is not an ideal one. Necessarily, where a person is employed at two different kinds of work, the one will take precedence while the other is regarded as secondary. This gives rise to many complications, and were it not for the exceptional tact and capability of those now holding this difficult relation with the department, the situation would soon become impossible. I would respectfully recommend that in the future arrangement of work such diffusion of energy be avoided, or that a more careful allotment of time at the disposal of the department be made.

The work of the year has proceeded pleasantly and harmoniously. We have great cause for congratulation in the personnel of our force. The work has been energetic, conscientious and successful, and has enlisted the cordial coöperation of the student body.

For the coming year we propose to arrange a graduated system of reading in literature through the four classes, using it as a basis for much of the written work in English.

Respectfully submitted,
HOWARD EDWARDS,
Professor English and Modern Languages.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF THE WOMEN'S DEPARTMENT.

To the President:

The Dean of the Women's Department has the honor to submit the following report for the College year, September, 1898-June 30, 1899:

The present incumbent of the office of Dean took charge of her work September 12, 1898. Mrs. J. L. K. Haner continued her instruction in sewing and Mrs. Marshall retained charge of the work in music. Miss Ellen R. Rushmore, a Smith College woman with special training in her subject at Drexel Institute, took up the work in domestic science which had been begun so well by Miss McDermott. Miss Bertha Ronan, coming from the Normal School at Ypsilanti, organized the classes in gymnastics.

Physical Culture.—This work has been carried on enthusiastically by Miss Ronan. All students in the Women's Department, except a few excused by the President of the College, have taken the exercises in gymnastics. The examinations given at the close of the year show a marked improvement in the physical condition of women who have done the work under Miss Ronan.

Music.—The number of students receiving instruction in music during the year shows an increase in comparison with former years. Mrs. Marshall is still in charge of the instruction in piano and chorus singing.

The College chorus under Mrs. Marshall's direction has furnished music for various occasions, notably Washington's Birthday, Decoration Day and the chapel services on Sunday mornings.

The following tables indicate the number of classes and number of students in domestic art and domestic science:

DOMESTIC ART.—MRS. J. L. K. HANER.

Class.	Subject.	Term.	No. of hours a week.	No. of students.
Freshman	Wood work	Fall	2	42
Sophomores	Sewing	Fall, Winter, Spring	4	23
Juniors	Dressmaking	Fall	4	16
Juniors	Art needle work	Winter	4	20
Juniors	Millinery	Spring	4	16

DOMESTIC SCIENCE.—MISS ELLEN R. RUSHMORE.

Class.	Subject.	Term.	No. of divisions.	No. of hours.	No. of Students.
Freshman	Cookery	Fall	3	4	50
Freshman	Cookery	Winter	3	4	46
Freshman	Cookery	Spring	3	4	43
Sophomores	Household economy	Fall	1	1	17
Sophomores	Household economy	Winter	1	1	16
Sophomores	Household economy	Spring	1	1	14

The work of the Dean of Women has varied. Fall term, class work ten hours a week; Freshman, English. Winter term, class work one hour a week, English literature with Seniors four hours a week. Freshman, rhetoricals two hours a week; Freshman, English. Spring term, seven hours a week; Freshman English, and last two weeks of term five hours a week; Seniors in English literature.

In addition to classes, her work has been to grant permissions, sign excuses, general responsibility for the women in her department. Supervision of Abbot Hall and care of finances help to make up the duties of the Dean. In addition to this she has visited and spoken at Farmers' Institutes at St. Johns, Dearborn, Ann Arbor and Pontiac.

In the Winter term Mrs. McCallum was engaged to do some work in Abbot Hall formerly done by students. Previous to that time no one had been in the Hall to meet visitors or callers. This, too, was one of Mrs. McCallum's duties.

The number of women entered for work during the year is ninety-four. Three women were granted the degree B. S. and one the degree M. S. on June 16, 1899.

EQUIPMENT.

Tools have been added for Mrs. Haner's classes in woodwork. For the laboratory kitchen we have bought silver to the amount of $53.98, table linen, towels and a few dishes. In the office of the Dean a desk, a chair, a dictionary and a book-case have been placed. Dr. R. C. Kedzie has made a gift of eighteen books to the Women's Department. Of these books a large Shakespeare concordance is most valuable.

For these books the department has bought a book-case for $5.00. A large etching of Rheim's Cathedral is another item that will add beauty to the parlor of the Women's Dormitory the coming year.

The most hopeful feature of the Women's Department is not the certainty of a new building just granted by the Legislature, but the indication that there are women all over the State demanding the room that this new building will afford.

MAUD RYLAND KELLER.
Dean of Women's Department.

Agricultural College, Mich.,
June 30, 1899.

DEPARTMENT OF DRAWING.

To the President:

Dear Sir—I have the honor to present herewith a report of the work done in the Department of Drawing for the College year ending June 16, 1899:

During the first two terms the classes of the mechanical freshmen were in charge of Mr. Chace Newman, and, though I was in class frequently, the work was carried almost entirely by him. In the third term Mr. Newman gave the same classes instruction in blue printing, and prepared work for the ensuing year.

The classes of the Sophomore women in drawing have been in charge of Miss C. L. Holt. With very few exceptions the students have shown encouraging interest in their work and made commendable progress, more so than in a corresponding period last year. In addition to this, Miss Holt instructed the classes of the Agricultural Freshmen in freehand drawing four hours per day during the Winter term.

I have had charge of the classes in descriptive geometry, have instructed the Agricultural Freshmen in freehand drawing, and conducted classes in graphic arts and the history of art for Junior women. The last two being new subjects, have required all the time I could give them in preparation and looking up illustrations. The College is lacking in illustrative material, which is the life and soul of such subjects as those last mentioned. We have twenty-five beautiful photographs of Greek and Roman art, and something over two hundred lantern slides of sculpture and architecture. Prof. Barrows has kindly allowed the use of his lanterns and class room on several occasions.

While the work in the department has on the whole been fairly successful, the statement calls for qualification. I have little to complain of in the results achieved with the mechanical students, though even in their case there have been frequent interruptions of the regular work which have been detrimental.

Faithfully,
W. S. HOLDSWORTH,
Assistant Professor in Charge.

Agricultural College, Mich.,
June 30, 1899.

DEPARTMENT OF ECONOMICS AND HISTORY.

To the President:

It gives me pleasure to transmit to you the following report of work done in the department under my charge for the year ending June 16, 1899:

Owing to certain alterations in the course of study for the College, the Agricultural and Women students in the Sophomore and Junior classes, numbering 115, received instruction in English history during the Autumn term. This number was divided into four sections and met with me five times per week.

During the Winter term a class of fifteen Seniors elected political economy and met for recitation five times per week. Gide's and Walker's works in Economics were the texts used. During the same term a class of twenty Juniors met four times per week for the study of civics, using Fiske's Civil Government and Hoffman's Sphere of the State as text-books.

The changes in the course, noticed before, were responsible for a large increase in the work of this department during the Spring term. An assistant, Mrs. E. A. Blunt, was furnished me and the work divided. Mrs. Blunt met three divisions of Freshmen each day in English history, while a class of Seniors in United States history, a class of Women Sophomores in general history and a class of Freshmen in English history recited to me. I wish in this place to express the desire that a better division may be made, if possible, of courses in this department, so that the work of the Spring term and that of the Fall term may not be so illy proportioned.

Respectfully submitted,
WILBUR O. HEDRICK.
Assistant Professor of History and Political Economy.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

TWELFTH ANNUAL REPORT

OF THE

EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE OF MICHIGAN

UNDER THE HATCH ACT

FOR THE

YEAR ENDING JUNE 30, 1899

For members and organization of the State Board of Agriculture in charge of the Station, and list of officers, see pp. 4 and 5 of this volume.

EXPERIMENT STATION.

REPORT OF SECRETARY AND TREASURER.

The following account shows the receipts and expenditures of the Experiment Station for the year ending June 30, 1899:

		Dr.	Cr.
July 1, 1898—To	balance on hand	$1,700 52	
July 9, 1898	received from U. S. Treasury	3,750 00	
Oct. 21, 1898	received from U. S, Treasury	3,750 00	
Jan. 4, 1899	received from U. S. Treasury	3,750 00	
April 15, 1899	received from U. S. Treasury	3,750 00	
June 30, 1899	license fees on 73 brands commercial fertilizers	1,460 00	
	miscellaneous receipts, mostly farm products	903 07	
June 30, 1899—By	disbursements as per vouchers filed in the office of the State Auditor General		$18,167 93
July 1, 1899	balance on hand		895 66
		$19,063 59	$19,063 59

The bulletin list has been revised, with the requirement that all receiving same shall make personal application by postal card or otherwise.

Twenty-five thousand copies of station bulletins are now issued and the demand is increasing as farmers learn of their value. Several press bulletins have been issued and special information in bulletin form has been sent out by the station.

DISBURSEMENTS ON ACCOUNT OF U. S. APPROPRIATION.

Salaries:		
Director and administrative officers	$1,008 33	
Scientific staff	4,308 34	
Assistants to scientific staff	2,997 50	
Special and temporary services	101 56	
		$8,415 73
Labor:		
Monthly employes, 3; average rate, $35.00	$1,260 00	
Daily and hourly employes	2,036 19	
		3,296 19
Chemical supplies:		
Chemicals	$341 17	
		341 17
Half tones, etc.	$87 25	
		87 25
Carried forward		$12,140 34

Brought forward		$12,140 34
Seeds, plants, and sundry supplies:		
Agricultural	$269 08	
Horticultural	79 47	
Miscellaneous	56 39	
		404 94
Tools, implements and machinery:		
Repairs	$54 25	
New purchases	35 74	
		89 99
Furniture and fixtures:		
1 roll top desk	$30 00	
Sundry fixtures	30 24	
		60 24
Scientific apparatus:		
Sundry supplies	$204 26	
		204 26
Live stock:		
Cattle	$255 77	
Horses	3 60	
Swine	33 75	
Sundries	15 00	
Poultry	2 05	
		310 17
Traveling expenses:		
In supervision of station work	466 98	
		466 98
Contingent expenses	$17 84	
		17 84
Postage and stationery		156 18
Freight and express		139 34
Fertilizers		130 50
Feeding stuffs		634 41
Library		244 81
Total		$15,000 00

DISBURSEMENTS OF EXPERIMENT STATION—MONEYS OTHER THAN RECEIVED FROM UNITED STATES TREASURER.

Salaries	$755 85	
Labor	1,467 50	
Publications	10 50	
Postage and stationery	101 63	
Freight and express	11 57	
Seeds, plants and sundry supplies	504 58	
Fertilizers	24 09	
Tools, implements and machinery	26 09	
Feeding stuffs	124 29	
Chemical	5 36	
Repairs	7 00	
Traveling expenses	17 20	
Scientific apparatus	73 73	
Contingent expenses	38 54	
		$3,167 93
Balance on hand		895 66
Total		$4,063 59

SUMMARY OF TOTAL DISBURSEMENTS—CLASSIFIED FOR DEPARTMENTS.

Buildings and repairs to buildings	$131 34
Library	254 59
Farm	4,173 90
Garden	805 73
Chemical	322 21
Botanical	5 65
Zoölogical	13 63
Veterinarian	755 20
South Haven Station	1,938 77
Salaries	9,011 57
Apiary	172 04
Office	501 84
Sundry	81 46
Total	$18,167 93

REPORT OF THE DIRECTOR.

To the President:

The period covered by this report begins November 1, 1898, and closes June 30, 1899, except as to the bulletins published.

There have been issued in the year ending June 30, 1899, the following bulletins:

No.	Title.	Author.	Department.	Pages.
162	Forestry Bulletin	Several		39
163	Strawberry Culture	L. R. Taft and H. P. Gladden	Horticultural	37
164	Methods and Results of Tillage	M. W. Fulton	Agricultural	20
165	Draft of Farm Implements	M. W. Fulton	Agricultural	4
166	A Grade Dairy Herd	C. D. Smith	Agricultural	12
167	A Discussion of Farm Dairy Methods	G. H. True	Agricultural	14
168	Michigan Fruit List	L. R. Taft	Horticultural	14
169	Notes from the South Haven Sub-Station	L. R. Taft and T. T. Lyon	Horticultural	110
170	Vegetable Tests for 1898	L. R. Taft, H. P. Gladden and M. L. Dean	Horticultural	33
171	Bush Fruits for 1898	L. R. Taft and H. P. Gladden	Horticultural	7
172	Combating Disease Producing Germs	C. E. Marshall	Bacteriological	27
173	Killing the Tubercle Bacillus in Milk	C. E. Marshall	Bacteriological	11

The following special bulletins were issued in the same period:

No.	Title.	Author.	Date.
9	Farm Accounts	C. D. Smith	November, 1898.
10	Sugar Beets	C. D. Smith and R. C. Kedzie	January, 1899.
11	Treatment of Frozen Trees	L. R. Taft	March, 1899.
12	Spraying Calendar	L. R. Taft	March, 1899.
	Press Bulletin No. 12, Treatment of Wheat for Smut	C. D. Smith and C. F. Wheeler	

Elementary Science Bulletins as follows:

No. 5	Branches of Sugar Maple and Beech as seen in Winter	W. J. Beal.
No. 6	Potatoes, Ruta-Bagas and Onions	W. J. Beal.
No. 7	Convention of Trees in 1898	W. J. Beal.
No. 8	Convention of Trees in 1899	W. J. Beal.

It is gratifying to report that there have been no changes in the working force of the Station during the period covered by this report except that Mr. M. W. Fulton, who has had charge of the work in soil physics, left the Station in December, 1898, to take charge of a dairy farm near Detroit.

In nearly all of the divisions of the Experiment Station the continued work planned in the years previous has been carried forward, if not to completion, certainly to advanced position. In the Agricultural Division the experiments with Indian corn testing the influence of thickness of planting were repeated. The former work is reported in Bulletin 154. The same distance apart of rows was used in this test, viz.: in Plot 1, seven inches apart, the plot being sown with a grain drill every tube sowing; Plot 2, fourteen inches apart, each alternate tube of the drill sowing; Plot 3, twenty-eight inches apart; Plot 4, forty-two inches apart; both latter plots being put in with a grain drill; Plot 5, in hills forty-five by forty-five, and Plot 6, rows forty-five inches apart and hills twenty-two and one-half inches apart in the row. The yields per acre both of green forage and of dry matter, and finally the yield of protein per acre are given by plots in the table below.

No.	No. Stalks in 100 ft. of row.	Stalks per acre.	Yield per acre, pounds.	Dry Matter per acre, pounds.	Protein per acre, pounds.
1	205	153,082	15,816	4,295.63	209.25
2	176	65,713	17.938	5,129.24	272 50
3	189	35,284	19,816	5.923 00	377 56
4	185	23,025	16,571	5,533 05	390.75
5	123	14,342	20,943	7,428 48	557.12
6	243	28,250	24,409	7,744.98	517.94

The gradual and important increase in the yield of both dry matter and that most important element, protein, as the distance between rows and between individual plants is increased is significant. It confirms similar results obtained in the past two years and with them goes far to demonstrate the proposition that to obtain the greatest yield of valuable nutrients it is wise to plant corn in rows fully three and a half feet apart, either in hills equally distant or in continuous row, the kernels being between six and nine inches apart in the row. It is folly to drill in corn in rows so close together that the ground can not be cultivated nor the sun gain free access to each plant.

The test of the grade herd still continues. The economic success of last year's operations was reported in Bulletin 166. It was shown that although the herd was brought together quickly without opportunity to select individuals from a large number offered, still the average yield was over six thousand pounds of milk and three hundred pounds of butter per cow for the year. The herd is improving in physical condition and good results may be expected from it this year.

The establishment of several costly beet sugar factories in the state in 1899 calls for renewed energy in the experiments related to beet growing. In 1898 the work of the preceding year was continued as far as sending out beet seed, furnished by the Department at Washington, was concerned. In addition careful account was kept of the expenses of growing a crop and the net profit therefrom.

In the matter of the introduction of new and valuable plants, mention should be made of the hairy vetch, referred to in Bulletin 149, as giving some promise when sown with oats in field No. 8. We have tried the plant more extensively since that time and it gives promise of becoming a valuable addition to the list of legumes to be used as a green manure. Rape continues to be an invaluable forage crop for sheep and is well-nigh indispensable as an autumn forage plant where a large flock is kept on a farm too small to furnish a large acreage of ordinary pasture. Many letters from widely separated sections of the state show that it is being introduced quite generally on the farms of sheep owners in Michigan.

Clover has proven a failure generally over southern Michigan, yet on the College farm the seeding of 1898 offers a good stand in the spring of 1899. This fortunate condition is due to the fact that the main field of clover is virgin soil, and that the plots sown on poor sandy soil were sown without a nurse crop, again calling attention to the value of this method of securing a fair crop of clover hay in a bad year.

As mentioned in the last report of the Station, much of the energy of the Agriculturist is devoted to the solution of questions relating to soil fertility, methods of testing present fertility and means of increasing the productivity of soils by the application of either barn-yard manures or commercial fertilizers.

The loss of the peach trees in the northern portion of the "fruit belt" along the western coast of the state has called attention to the wisdom of carefully selecting locations for peach orchards before planting extensively.

The energies of the Bacteriologist have been absorbed by the experiments in tuberculosis at the College and investigations as to the cause and treatment of so called hog cholera at various outbreaks over the state at large. The work along the latter line is very far from satisfactory, because lacking in definite aim. The investigations so far have clearly pointed out that the germ causing one outbreak is different from that causing an outbreak in a herd, it may be not far distant from the first one. The microscopic symptoms in the two cases may be nearly identical, but Bacteriologists find a distinct germ in the two cases. We cannot therefore, hope for very immediate and decisive results from the work carried on along this line, but the financial losses due to these swine diseases are so great that the work must be continued until we know the cause of the disease and the means of prevention.

At the date of this report Mr. Marshall is studying in the laboratory of Dr. Alfred Jorgenson in Copenhagen, and we hope next year to undertake the work with added skill and energy.

The South Haven sub-station has made its important impress on the fruit growing interests of western Michigan, largely because of the unique ability of ex-President T. T. Lyon. It is painful to record the close of his life work, and the necessary severing of the close bonds that have bound his genius to the work of the Station. I shall leave it to others to fitly characterize the invaluable services he has rendered his State and his country. A fit eulogium could hardly find place in the dry and didactic pages of an official report. Since the acceptance of his resignation the work of that sub-station has been carried forward with ability by Mr. S. H. Fulton, a graduate of this College in 1897.

The coöperative experiments in the Horticultural Department have been somewhat extended in the year 1899. Certain fruit tree diseases demand experiments in the orchards of commercial fruit growers. I am glad to report that the practical horticulturists coöperate with the Station in carrying forward this valuable set of experiments.

An interesting detail of experimental work is the breeding of bees with longer tongues, by the apiarist. It is to be hoped that the continued selection and breeding will result in the development of a race of honey bees able to extract nectar from the clover blossom.

I submit herewith, as part of this report a statement by Prof. Mumford concerning the livestock experiments for the year ending June 30, 1899, and the regular stated reports of the Agriculturist, the Horticulturist, the Chemist, the Apiarist and a full set of the bulletins issued during the year.

Respectfully submitted,
C. D. SMITH,
Director.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF THE AGRICULTURIST.

Professor Clinton D. Smith, Director of Experiment Station:

I herewith submit the Annual Report of the Agricultural Department of the Experiment Station for the year ending June 30, 1899.

The work of the agriculturist for the period covered by this report has been confined more to planning and inaugurating than to recording results.

The department has under its charge a portion of Field 3, set aside for experimental work some ten years ago, and divided into one-tenth acre plots, the whole of Field 6, about three acres of muck land in Field 13, all the College woods, and the pine plantations along the west line of the farm and in Field 21. There is a small, well arranged barn for the storage of grain and tools, and the preparation of seeds and fertilizers. A pair of horses which do practically all the work, and a few tools make up the equipment of the department. Two men are employed during the entire season, and four students during the summer vacation. The above, together with the students assigned to the department during the Spring and Fall terms, make up the labor force of the department.

SHRINKAGE EXPERIMENT.

An experiment to determine the shrinkage of stored grain and hay has been completed, and the results are ready for publication.

Considerable quantities of clover hay, timothy hay, oats, wheat, corn, and Hungarian grass seed were carefully weighed and stored at harvest time, and again weighed after being stored for a period, to determine the loss.

Variety tests of wheat which can only be conducted on large areas are being made on the College fields. The work of this test so far as it applies to the simple production of the wheat crop is done by the College, the Experiment Station attending only to such details as measuring the ground, preparing the seed, weighing the crop and noting and recording the results.

CLOVER.

Plots of alsike, Russian, mammoth and June clover, sown in May, 1898, have withstood the winter and promise abundant crops. Two plots of sand lucerne, *medicago media*, were cut June 1st, yielding over two tons per acre. This is a new plant with us, but it bids fair to take a prominent place among our forage and hay crops.

In 1896 several experiments were begun, consisting of continuous cropping with wheat, corn, grass and clover, continuous fallow, and the following rotations:

Two year—Wheat, clover.
Three year—Wheat, clover, corn.
Three year—Wheat, clover, potatoes.
One year—Rye and beans.
Four year—Oats, wheat, oats and peas—rape.

All of the above are being carefully maintained in duplicate on plots in Field 3.

On another series of plots on which a fertilizer test was begun in 1894, a soil test experiment with fertilizers has been inaugurated, the object being to determine to what extent our soil is exhausted and what materials we must apply to keep up the supply of available plant food. The plan of this experiment accords with the one suggested by the office of Experiment Station, and is substantially as follows:

The area to be tested is divided into plots of equal size and uniform fertility. Three of the plots are fertilized with the single elements—nitrogen, phosphoric acid and potash; another three with combinations of two elements; and another plot with all three elements. As a source of nitrogen, nitrate of soda was used; of phosphoric acid, dissolved phosphate rock; and of potash, muriate of potash. For the sake of comparison, stable manure and commercial fertilizers were each given a plot, while several plots were planted without the application of any fertilizer. To make this experiment more complete and give it a more general application to our Michigan soils, the department offered to furnish fertilizers and superintend the work on a limited number of farms in the State. This offer was promptly accepted, and soon more than enough applications were presented. The following men are conducting these experiments on their own farms:

L. B. Walton	Dryden	Lapeer county.
J. Y. Clark	Orion	Oakland county.
Bruce Phillips	Utica	Macomb county.
Glen C. Lawrence	Ypsilanti	Washtenaw county.
E. C. Reed	Howell	Livingston county.
L. L. Thompson	East Cooper	Kalamazoo county.
A. E. Gregory	Dowagiac	Cass county.
H. M. Kingsley	Kendall	Van Buren county.
H. D. Weatherwax	Jenison	Ottawa county.
T. P. Steadman	Manistee	Manistee county.
O. C. Wheeler	Belding	Ionia county.
—— Mills	Mancelona	Antrim county.
L. R. Williams	Otsego Lake	Otsego county.

The same experiment is being conducted by M. H. Lapham, under direction of the department, on the Parmelee Farm, opposite the College.

SOIL TEST ON MUCK LAND.

A portion of muck in Field 13 is being treated with a variety of applications to determine its requirements and the crops best adapted to it under the various treatments. This soil is similar to large tracts of muck land in the State, which, though subdued and planted do not respond with profitable crops, and the department proposes to carry out the work on this line until some definite results are obtained.

The care and supervision of the College woods and pine plantations occupy a portion of the time of the agriculturist and his working force. The dead and dying trees are being cut into wood, and the young trees allowed to grow. The pines receive frequent cultivation, and are growing nicely.

SUGAR BEET EXPERIMENTS.

Investigations looking to the solution of many of the problems connected with the sugar beet industry are being made. Testing of varieties, and methods of cultivation, the fertilizer problems and the growing of beets for seed are the principal lines of work being carried forward this season.

During the winter of 1898-9 the Agriculturist devoted nine weeks of his time to Farmers' Institute work.

Respectfully submitted,
J. D. TOWAR,
Agriculturist.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF EXPERIMENTER WITH LIVE STOCK.

To the Director:

I have the honor to submit the following, concerning Live Stock Experiments for the year ending June 30, 1899.

The question is often asked to what extent can silage and sugar beets be fed to pregnant breeding ewes without being followed with unwanted results. It has recently been a question of dispute as to whether roots or silage are best for breeding ewes, taking everything into consideration.

It was to discover data leading up to the solution of these two questions that the undersigned planned an experiment as follows: Twenty-four Shropshire ewes were separated into two pens of twelve each. One pen was fed, in addition to a grain ration and hay, sugar beets. The other pen, silage.

Observations as to general health and condition, loss or gain in live weight, were frequently taken. The ewes were carried through the critical time of lambing so that we might observe deleterious influences if they were exerted by the feeding of the succulent foods named above. The quantity of roots and silage varied, but on the whole averaged about three pounds per head per day.

It was found that when the same number of pounds of silage and roots were fed there was a marked tendency for the ewes fed on silage to gain in weight, while those fed on roots about held their own. The ewes in both pens were large Shropshire ewes averaging from one hundred fifty to one hundred seventy-five pounds each.

The ewes were all in good thrift at lambing time and were singularly free from the difficulties of lambing not infrequently causing much trouble and serious losses.

We concluded that there need be no bad results following either the use of silage or sugar beets in the winter ration of breeding ewes, but that there is a decided advantage.

Such feeding should not be excessive. We much prefer restricting the amount of sugar beets or silage in the ration to about three pounds per head per day.

In the trial of feeding skim milk to pigs it was found that where fed to a mixed lot of fifty hogs varying in weight from fifty to two hundred pounds, and when in conjunction with corn meal, that the skim milk was worth about fifteen cents per hundred pounds, with hogs at $3.60 per hundred weight.

For the benefit of those who may be watching with interest the experiment in soiling sheep in No. 14, I may say that thus far we have found rye, oats and peas, rape and sorghum the most useful plants for this purpose, and of these rape unquestionably stands at the head.

It has been shown that good mixed grass pasture will keep the sheep up in better condition than will rye pasture.

We believe the experiment has been carried far enough and long enough to show that it is not practical except where a failure of pasture makes some such provision necessary.

We are now preparing a bulletin on wool which will be forth-coming in a few months.

Respectfully submitted,
HERBERT W. MUMFORD.
Assistant in Agriculture.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE HORTICULTURIST.

To the Director:

I have the honor to present the following report of the work of the Horticultural Department of the Experiment Station for the eight months that have elapsed since the last report was made. Owing to the fact that the report made in November, 1898, covered the experiments made during the year of 1898, I can only outline those that have been undertaken for the present season.

EXPERIMENTS AND PROGRESS.

In addition to a large number of new varieties of vegetables that are being tested, we have at the request of the United States Department of Agriculture undertaken a comparative test of the different varieties of lettuce. Seed of nearly two hundred fifty varieties were furnished.

and they are being grown with the idea of noting the synonyms and the characteristics of the different varieties.

The experiments with potatoes include a test of all of the new varieties that could be secured, and series of plot tests designed to show the best distance and depth for planting and the most profitable amount of seed that can be used. We have also undertaken a series of fertilizer tests for which twenty one-tenth acre plots have been used. These have been treated with a variety of commercial fertilizers, together with various combinations with stable manure and wood ashes.

A series of experiments with various insecticides and fungicides has also been arranged and especial attention will be given to spraying experiments for the leaf curl of the peach and the apple scab fungus. We are also experimenting with a number of insecticides that have been sent here for trial and are testing different forms of spraying machinery.

THE COLLEGE ORCHARDS.

Although nearly all of the hardier apple, pear, plum and cherry trees have apparently escaped with little injury from severe winter, the peach trees that are three years old show the effects very seriously, and many of them will undoubtedly die. On the other hand, many of the young cherry and apple trees show considerable injury, and most of the grapes have been killed to the ground. While it is yet too early to determine the extent to which the different varieties have escaped, it is evident that many kinds that have been considered hardy are fully as much, if not more, injured than others that have been classed as somewhat tender. This is particularly noticeable in the apples, as many of the Russian varieties appear to be seriously injured.

The strawberries were heavily mulched and have come through the winter in good condition, but the more tender varieties of all raspberries and blackberries were killed to the ground, and will give little, if any fruit, the present season.

SOUTH HAVEN SUB-STATION.

As noted in Bulletin 169, President T. T. Lyon, who had been in charge of the experimental work at South Haven from the establishment of the Station in 1889, was obliged, owing to failing health, to resign at the close of last season, and to succeed him S. H. Fulton, a graduate of the College in 1897, was secured. After graduating Mr. Fulton spent two seasons upon a large fruit farm in western New York, where he had charge of a large amount of experimental work for the Geneva Experiment Station.

Owing to the ameliorating effect of Lake Michigan the injury from the winter was far less severe at South Haven than at the College, but up to the present time it seems to be confined to the peach trees, some of which were considerably injured, but with a favorable season it is probable that most of them will, to a large extent, recover and fruit may be expected from any of the varieties. In addition to the variety tests that are being made, considerable work is being done in the way of experiments in spraying and thinning fruit.

CO-OPERATIVE EXPERIMENTS.

As in previous years, arrangements have been made with parties in various portions of the State who will carry on work in testing different varieties of small fruits and potatoes. The number of persons to whom plants and seeds can be supplied is comparatively small, as arrangements for this work can be made with but one person in each county.

LITTLE PEACH.

As has been noted in previous reports, a disease to which the above name has been given is doing much harm in portions of Allegan and Van Buren counties. While the exact nature of the disease has not been ascertained, it is evidently quite distinct from any of the common diseases of the peach. In order to ascertain what could be done to lessen or prevent injury from the disease, a number of experiments were undertaken in three orchards near Douglas, Michigan. The treatment consisted in heading back the trees in various degrees and in the use of a number of fertilizers. In carrying on this work we were greatly aided by C. B. Welch and H. G. Welch and by the owners of the orchards—Messrs. Purdy, Howland, and Phillips.

ASSISTANTS.

During the year there has been no change in the assistants in this department and Messrs. H. P. Gladden and M. L. Dean have carried on the work in lines similar to those reported last year. At the close of the season's work in 1898 they prepared the bulletins giving the results of their experiments.

BULLETINS.

During the last six months the results obtained from the field experiments conducted during the season of 1898 were published as bulletins. No. 168 was entitled "Michigan Fruit List," but in addition to giving a list of more desirable fruits it devoted considerable attention to the planting and care of the trees. Bulletin 169 contained the report of the South Haven Sub-station for 1898, while Nos. 170 and 171 treated respectively of the Tests of Small Fruits and of Vegetables improved during the past year.

L. R. TAFT,
Horticulturist.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF THE CHEMIST.

Professor C. D. Smith, Director of the Experiment Station:

Sir—I herewith place in your hands the report of the work of the Chemical Department of the Experiment Station for the College year from June 30, 1898, to June 30, 1899.

1. *Fertilizers.*—One of the most important duties of this department is the collecting and analyzing the commercial fertilizers offered for sale in this State, and giving to the public this information in the form of an annual bulletin. For the current year seventy-five samples of such commercial fertilizers have been collected in the open market and the manuscript for the bulletin is ready for the printer and will soon be issued.

Two samples of wood ashes and one each of lime, nitrate of soda, sulphate of potash and bone black, designed for manurial purposes, have been analyzed.

2. *Food Stuffs.*—Ten samples of wheat, seven of ensilage, two of oilmeal, two of buckwheat bran, one sample each of corn bran, oat bran and sugar beet pulp, have been analyzed. A sample of so called Acme Stock Food, and one of Pratt's Stock Food, have been analyzed. A specimen of "Lactobutu," "will sweeten old rancid butter and increase the quantity one-third," was obtained from the Lacto Butter Co. of Chicago, by the payment of $5.00. This also was analyzed. The great claims of Acme Stock Food as a fodder greatly exceeding in food value oilmeal and other concentrated foods, and the extraordinary claim of Lactobutu to renovate rancid butter and change ten pounds of rancid butter and five pounds of milk into fifteen pounds of good butter as "the milk will all turn butter"—the statements in both cases being of so astounding a nature that it was considered desirable that both these substances should be analyzed and the results given to the public. This was done and a press bulletin prepared setting forth the composition of these substances and exposing their pretensions. It is expected that this press bulletin will be issued soon.

3. *Sugar Beet Industry.*—In further efforts to promote the beet sugar industry in Michigan one hundred seventy samples of sugar beets were analyzed, to show beyond cavil the fitness of our soil and climate to produce beets rich in sugar and well fitted for making sugar in the factory.

In the same connection a number of samples of water were analyzed to determine their fitness for use in a sugar factory.

The class of young men twenty-three in number, who took a course of instruction both theoretical and practical in the chemistry and technology of the beet sugar industry under Prof. Wolff, may be mentioned as showing the trend of certain lines of work in the Chemical Laboratory.

4. *Miscellaneous.*—Various kinds of work are carried on here not easy of classification. Four samples of honey were analyzed and several samples of water to determine their fitness for culinary use. Questions of this kind seem to naturally gravitate to the Chemical Laboratory.

Most of the analytical work has passed through the hands of L. S. Munson, B. S., the efficient assistant in the Chemical Department.

The systematic meteorological observations and records begun here in 1863 are still carried on and the records given to the public year by year. These become more valuable with every added year.

Respectfully submitted,
R. C. KEDZIE,
Chemist Experiment Station.
FRANK S. KEDZIE,
Adjunct Professor of Chemistry.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF CONSULTING ZOOLOGIST.

Professor C. D. Smith, Director of Experiment Station:

SIR—I have the honor to submit the following report of the work of the Zoölogical Department of the Station for the past year:

There has been no change in the personnel of the department, and the duties of its members have been much the same as in former years. It has been found necessary, however, to draw the line more sharply than heretofore between the work of the Station and that of the Academic Department, owing to the pressure of work in the latter department and the fact that the Station pays but $500 per annum for this work.

A large part of the year's work, as heretofore, has been in correspondence with agriculturists scattered throughout the State whose crops are attacked or threatened by insects; but there have been many inquiries also in regard to birds, reptiles, fish, and mammals, as well as the usual number of queries from teachers and others seeking information as to the best text-books or books of reference in zoölogy and kindred sciences.

Among the hundreds of letters answered, too many by far relate to such common insect pests as the tent-caterpillar and canker-worm, insects which are readily controlled by simple methods, but which nevertheless continue to swarm unmolested every year in some sections of the State, and doubtless will do so for all time to come. Other well known injurious insects are the cutworms, grasshoppers, and squash-bugs, all of which have been destructive during the past year. Unlike the species last mentioned, these foes are not easily controlled and their presence is not necessarily an indication of thriftlessness or neglect. However, the intelligent and industrious farmer learns eventually how to minimize these evils and it is the part of the Station entomologist to give to such every aid and encouragement possible.

The clover-leaf weevil (*Phytomomus punctatus*) and its several associates, which in recent years have given so much trouble, would seem to be growing less numerous, judging from the paucity of complaints during the past twelvemonth. Probably intelligent methods of combating them, combined with the natural increase of their enemies, animal and vegetable, are having their proper effect. The Hessian-fly has figured conspicuously in the newspapers and in the crop reports, yet our correspondence would indicate that here again the same factors are making themselves felt, and that the natural enemies of this insect stand ready to mitigate the plague whenever the farmer will do his part toward intelligent restriction.

Many complaints are received every year in regard to the insects which infest stored grain and other seeds, particularly peas and beans. In most cases we have found the prescription of carbon bisulphide perfectly satisfactory, though its cost makes it rather expensive on a large scale. Complaints of the carpet beetle, clothes moth, and other household pests to which the same remedy is applicable have not been as frequent as usual.

During the summer of '98 we had a few letters relating to the forest tree tent-caterpillar (*Clisiocampa distria*), and this summer the worms have appeared again in considerable force. So far as we can learn, the principal damage has been in the northwestern counties of the Lower Peninsula, particularly in Grand Traverse, Antrim, Kalkaska and Otsego counties. The caterpillars work mainly on hardwood trees, and in some places have stripped thousands of acres of forest trees of their entire foliage. In one case they are reported to have massed on a railroad track in such numbers, while moving from a devastated area to another, as to stop trains on an up-grade and cause considerable delay at that point. In this case they were wrongly called "army-worms," a not unnatural mistake, and one constantly made in the southern part of the State in the case of the common canker-worm. The true army-worm (*Leucania unipuncta*) is a cut-worm which commonly originates in wet grass lands and then spreads or "marches" over the surrounding fields. No notices of this latter species were received during the year.

The Pear Psylla, *Psylla pyricola*, which appeared in one or two places in the late summer of 1897, has not spread to any great extent, and has not justified the fears so generally expressed. It may yet cause severe trouble among the fruit growers of the State, but the fact that it has been present for several years without doing so, and that our fruit men have been warned and are on the lookout for it, will tend to lessen the severity of the attack if it does come.

The strawberry leaf-roller (*Phoxopteris comptana*) was reported as dangerously common last summer in parts of Berrien and Cass counties, and it is probable that it was present elsewhere in harmful numbers. There is some hope that its native enemies may increase rapidly enough to check its increase, but otherwise it will have to be fought year after year at considerable expense. We have also had complaints of two species of strawberry saw-flies, whose presence is to be deprecated.

The San Jose scale is now in the hands of another officer, whose report will be found elsewhere; this office has merely given advice when appealed to, and identified all doubtful specimens submitted. It may not be amiss to add, however, that the apparent failure of this dangerous scale to multiply and spread as expected should not diminish our watchfulness in the least or lead to the neglect of all necessary precaution. A large area in Michigan is certainly adapted to the needs of this pest and we may be sure that, once fairly introduced and established, that area will never again be entirely free from it, no matter what the appearances may be.

Other scale insects have demanded attention from time to time, and we have received samples of half a dozen species which have done more or less damage. Remedies have been prescribed according to the species and the degree of infestation, but complete immunity from these troublesome insects will only be obtained at the price of "eternal vigilance."

The sugar beet industry has brought to the front several species of more or less common insects which live to some extent on this crop. Most of them are well known and can be overcome or guarded against with little trouble. Thus far we have seen most damage from a small beetle known as the pale-striped flea-beetle, *Systena blanda*, but several other beetles are often associated with this species, as well as one or more bugs, a leaf-miner, several caterpillars, and some other enemies. Studies of some of these are in progress now and the results will be published as soon as ready.

A new enemy to the peach has appeared in the form of an undescribed species of leaf-roller. Thus far its work does not seem to have been very general or harmful, but there are disagreeable possibilities in any such case, and our studies of this insect are being prosecuted with a view to meeting any developments which may occur.

The preceding paragraphs give an incomplete outline of the work of the department during the past year. A bulletin on the insects of the year 1898 is now ready for the printer, and in it will be found further details of the work on some of the species mentioned above, as well as other matters which it is believed will be of value to the agriculturists of the State.

Respectfully,
WALTER B. BARROWS,
Consulting Zoologist.

Agricultural College, Mich.,
June 30, 1899.

REPORT OF THE BACTERIOLOGIST.

Director C. D. Smith:

Dear Sir—The bacteriological investigations for the past year may be included under three heads,—hygienic, dairy and plant bacteriology. In hygienic work we have had to deal with tuberculosis and the so-called hog cholera; in dairy manipulations our attention has been called to cleanliness in handling milk, and gassy cheese; and in plant diseases our efforts were directed at the causal agent of crown gall in peach trees.

The general plan adopted on the start for the investigation of tuberculosis has been followed as closely as circumstances would allow. The hygienic treatment and isolation of the tuberculous animals, together with the breeding of the condemned animals, have been brought to a conclusion in large part by the slaughter of the animals and the returning of two or three to the sound herd. Although it would have been intensely interesting to follow these animals until they had either recovered from the disease or had succumbed to it, yet it was thought that they had served all practical purposes, inasmuch as some of them had become incapable of producing off-spring.

The tuberculin test was carried out with all due precautions, such as were employed the year preceding. There were evidences of possible error in the tuberculin test disclosed, and, again, we repeat the warning, there should be as many normal temperatures taken previous to injection as time and expense will permit. Furthermore, it has been demonstrated that an animal may, after reacting once, pass over two years without reacting, notwithstanding the fact that it has been tested semi-annually. No new cases of tuberculosis were found this year, unless it be one about which there is some doubt. What the tuberculin test has done with the college herd in weeding out tuberculosis cannot be over-estimated, and its value as a diagnostic agent, although not infallible, cannot be questioned in the light of our present knowledge. It can be thoroughly recommended for common use. Every herd in Michigan should be tested, because it is a matter of economy. If tuberculosis is checked at the present moment, it means that the disease will not spread. That it can and will spread cannot be gainsaid. The history of the college herd illustrates this single point, for, since its incipiency, it has become more and more difficult to cope with, until the use of tuberculin began in 1896.

Laboratory work on the thermal-death point of the tubercle bacillus has been carried on for the sole purpose of establishing whether pasteurization at 70° C. for twenty minutes is sufficient to kill the germ which causes the dreaded "white plague." The experiments demonstrate conclusively that such treatment will kill the tubercle bacillus if the pasteurization is properly done. Stress is placed upon the care necessary for proper pasteurization. The results of these experiments have been published in bulletin form. To the above might be added with advantage the method now in general use in Denmark. The milk or the cream from which butter is made is heated momentarily to 85°-95° C., and then the milk is suddenly cooled down to 10° C. The sudden cooling seems to have a marked effect on the value of the butter. I quote from a free translation by Mr. C. W. Sorensen, a dairy expert: "In the prompt and thorough cooling of the cream lies the crux of the whole question. Even 95° C. was repeatedly employed without any permanent cooked flavor being at all noticeable, so long as the cooling was efficient. Although the butter had a slight peculiar flavor when first made, this invariably disappeared in the course of one or two days. Comparisons between butter made from milk or cream pasteurized at 85° C.-90° C. and from portions of the same cream heated only to 72° C. showed that not only was the former as good, but, in many cases, was better than the latter. The cooling is as important as the heating itself." * * * "While on the subject, it may be interesting to know that out of the 713 factories competing last year in the Danish 'State Butter Shows,' all except five pasteurized the whole of their output—four of these five had the unenviable distinction of occupying the four bottom places in the official list, while the fifth was not much better—and all but eleven used 'commercial starters.'"—(Written for the New Zealand Dairyman and Dairy Messenger.) Mr. Sorensen further states that these Danish experiments extended over all seasons of the year, were carried on in four different localities and constituted fifty-two distinct experiments by the scientific experts of the experimental school of agriculture. These remarks are inserted to show that the great cry against pasteurization is without foundation, for Danish butter is first on the London market, and also that it is not necessary to hold to 70° C. for twenty minutes in the pasteurization of cream for the making of butter, but the temperature may be as high as 90° C. without danger to the quality of the butter. However, the cooked flavor of the milk is quite perceptible at this temperature and does not disappear, as in the case of butter.

The investigations of Michigan milk for tubercle bacilli continue. Many obstacles are met with in securing fair samples, consequently this line of work may be prolonged for some time. The object of these tests is to gain some idea of the infectiousness of Michigan milk from tuberculosis by selecting fair samples from various parts of the State and subjecting them to a bacteriological examination upon animals. The microscope will not be depended upon, because of its unreliability in such examinations.

During the past year many weeks of my time and energy have been expended upon the study of the so-called hog-cholera as it occurs in Michigan. This disease probably causes more financial loss than any other disease among animals in the State. It is of peculiar interest because of the wanton carelessness and indifference with which it is managed by swine owners, and because also of its variable nature and its probable variance with hog cholera. Numerous examinations have been made of hogs dying from the disease and hogs nearly dead. Bacteriological examinations have extended into the hundreds of guinea pigs and rabbits inoculated and several hundred tube and plate culture inoculations. Much evidence has accumulated and the indications are very suggestive, yet with our knowledge limited to perhaps a dozen outbreaks and our experiments to rabbits and guinea pigs, we do not feel justified in drawing any conclusions or uttering positive statements until the work can be taken up more systematically and thoroughly and carriel to a finish. The questions to be solved are: Is it hog cholera or not? Is the disease the same throughout the State, or is there a variety of diseases? What is the cause or causes of this disease or diseases? How shall this disease or these diseases be managed? Is a preventive treatment able to eradicate it, or will a cure have to be found? To answer the above questions, it will be necessary to devote one's whole time to the matter, and considerable expense will be incurred in visiting and studying outbreaks as well as the providing of young pigs for experimental purposes. It is a subject well worthy of serious attention.

Some attention has been given to dairy work, but not as much as it deserves. For two years past I have been advocating the use of a separate milking room to the students in the short dairy courses. This has been done under the hypothesis that the fighting of bacteria by means of pasteurization and other methods is only inviting a continuous struggle which will never lead to the most satisfactory results. *It virtually amounts to the insertion of filth into milk, and then devising methods by which we may get rid of it.* If it is possible to so handle the milk, even if it is at a third more expense, so as to keep the milk in its practically pure condition as it comes from the udder, such milk is absolutely under the control of the dairyman. With the one factor, the disease of the animal eliminated, there remains a single factor in the securing of pure milk. Nearly a year ago work was started along this line, and sufficient was done to demonstrate the feasibility of the plan. The work has been dropped for the time being, owing to the pressure of other investigations and circumstances not under the control of the investigator. However, it is hoped that this work may receive all the attention it needs, for, since studying the conditions elsewhere the author has found that the above plan is to be adopted the coming winter by one of the leading milk companies of the world. This practical test will be watched with keen interest, for in it may be the solution of a problem which will eventually yield beneficial results to milk producers and to milk consumers. The isolation of a gassy cheese bacterium some time in the past has kept our attention centered on its relation to the process of cheese-making. Much has been done with it in a practical way, but much more ought to be done. On account of a lack of facilities in cheese making, we are unable to go on with this work.

For the past two years we have been engaged with the study of crown gall in peaches. Nearly one thousand peach trees have been used in the experiments which cover several phases of the subject. This fall will close this set of experiments, but we hope to follow them with others under different conditions. The investigations may be said to be progressing as favorably as could be expected, and the results are taking definite form. However, two more years must elapse at least before we can give our results, for, beginning at the very bottom of the matter, it must needs develop slowly if any trustworthy conclusions are reached.

As a conclusion, I may add that many samples have been analyzed for farmers during the course of the year, and in connection with the "State Live Stock Sanitary Commission" several bacteriological analyses have been made.

Very respectfully submitted,
CHARLES E. MARSHALL.

COPENHAGEN, DENMARK,
June 20, 1899.

The report has been written without access to my notes; accordingly, no details have been inserted.—(Author.)

REPORT OF THE APIARIST.

To the Director:

SIR—The following is the report of the work done in the Apiary from November 1, 1898, to June 30, 1899:

The bees were put into the cellar late in November, thirty-two colonies in all after the weaker ones were united. The stores in the hives were almost all from boneset and coreopsis and all colonies had an abundance. Three colonies were fed sugar syrup entirely. The cellar was in good condition in the fall and the bees were quiet and seemed to be wintering finely. Temperature was kept at 45 degrees F.

During the extremely cold weather in February a water pipe froze and burst. This flooded the cellar before it was discovered, so that the water nearly covered the floor. As the drains were frozen solid, the water could not run off and so the air was loaded with moisture and gas. These conditions are not at all favorable to the successful wintering of bees, and, as a consequence, on April 13, 1899, when they were taken out, seven of the thirty-two colonies were dead and many more were weakened so much that they could not survive.

The lesson learned was that bees will winter successfully only in a perfect cellar, and if such a cellar is not available they should be wintered out of doors.

The three colonies that had sugar syrup for their stores came through the winter in good condition, showing that sugar is a good winter food under any conditions.

Owing to the weakened colonies there were no early swarms, May 25 being the first.

A course in bee keeping was given to the Agricultural Freshmen, sixty-five in all, each student having twelve hours work in the yard.

During the present season we hope to make several experiments along the line of foundation tests and migratory bee keeping, as well as many others. The condition of the bees at the present time is fair, and some honey is being stored.

During the winter I have attended the State Bee-Keepers' Convention and a few farmers' institutes. I have also visited many apiarists in this vicinity and in eastern Michigan.

Respectfully submitted,
J. M. RANKIN,
Apiarist.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE LIBRARIAN.

To the President:

SIR—I have the honor to present the following report on the library for the year ending June 30, 1899.

There have been 548 bound volumes added during the year, of which 193 came by purchase, 75 by binding, and 280 by gift; 245 pamphlets and unbound volumes have been added, of which 9 were purchased.

All gifts to the library, whether of bound volumes or pamphlets, were acknowledged when received. Individual mention of donors is therefore omitted.

One hundred twenty-six publications, both foreign and American, are purchased by the College and placed in the reading room for the use of students.

The following are donated or received in exchange:

- Adrian Times.
- Albion Recorder.
- Allegan Gazette.
- Agricultural Epitomist.
- Agricultural Gazette, N. South Wales.
- Ann Arbor Democrat.
- American Bee Keeper.
  - Creamery.
  - Horsebreeder.
  - Horticulturist.
  - Phil. Society Proceedings.
  - Swineherd.
- Baltimore Sun.
- Battle Creek Journal.
- Church Helper.
- Corn Belt.
- Copemish Courier.
- Clinton Independent.
- Detroit Free Press (Twice-a-Week).
- Evening News (Saginaw).
- Farm and Fireside.
- Farmer's Voice.
- Farming.
- Farm, Field and Fireside.
- Farmers' Advocate.
  - Home.
  - Guide.
  - Journal.
- Farm and Home.
- Farm Journal.
- Fruit Growers' Journal.
- Good Health.
- Grand Traverse Herald.
- Grand Rapids Herald.
  - Democrat.
- Grange Bulletin.
- Homestead.
- Hillsdale Leader.
  - Standard.
- Home Companion.
- Hoard's Dairyman.
- Home and Farm.
- Indiana Farmer.
- Industrialist.
- Ingham County News.
- Ionia Sentinel.
- Jonesville Independent.
- Journal of Agriculture.
- Kalamazoo Telegraph.
- Lansing Journal (daily).
- Land of Sunshine.
- Literary News.
- Midland Republican.
- Mark Lane Express (London).
- Michigan Fruit Grower.
- Monthly Weather Review.
- Michigan Mirror.
- Mirror and Farmer.
- Michigan Advocate.
- Monthly Bulletin Vital Statistics (Mich.)
- Moderator.
- New England Florist.
- N. Y. Weekly Witness.
- National Stockman and Farmer.
- Otsego County News.
- Onekema Lake Breeze.

Oregon Agriculturist.
Orange Judd Farmer.
Official Gazette.
Public Ledger (Phila.) Daily.
Pratt Institute Monthly.
Park's Floral Magazine.
Practical Farmer.
Proc. Amer. Soc. Civil Engineers.
Queensland Agricultural Journal.
Rhodora.
State Republican (daily).
Sault Ste. Marie News.
Sugar Beet.
St. Ignace News.
Salt Lake Herald.
Sound Currency.
Travelers' Record.
Traverse Bay Eagle.
Voice.
Western Agriculturist.
    Plowman.
Wolverine Citizen.
Wallace Farmer.
Western Society of Engineers.
Williamston Enterprise.
Ypsilantian.

The M. A. C. Record exchanges are also placed in the reading room.

Nineteen volumes have been added to the Experiment Station library; 13 by binding, 1 by purchase, and 5 from the U. S. Dept. of Agriculture.

In exchange for our catalogue, the library receives the year books, catalogues or registers from all the leading educational institutions of the country. We also receive the bulletins of the various experiment stations.

During the summer vacation new linoleum was laid on the floor of the reading room, the old covering being used to repair that of the library, which had been taken up and cleaned for the first time since its purchase in 1884. This work was done by students.

Library hours remain unchanged. The librarian has been assisted during the year by Mr. R. L. Brown and Miss Alice Cimmer, who have faithfully and satisfactorily performed their duties.

Our greatest need is for more room, and we all hope that in the near future our library, which now numbers 21,159 volumes, may be housed in a new and fire-proof building.

Respectfully submitted,
MRS. LINDA E. LANDON,
Librarian.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

REPORT OF THE STATE INSPECTOR OF NURSERIES.

The State Board of Agriculture, Hon. T. F. Marston, President:

As State Inspector of Nurseries and Orchards, I make the following report of the amount and condition of the San Jose scale and other injurious insects and diseases found in the orchards of Michigan, and of the work done for the year ending June 30, 1899, in compliance with Act 137, Laws of 1897.

San Jose scale in the State today, so far as is known, is confined to five small colonies, located in the counties of Allegan, Ottawa, St. Joseph, Calhoun and Ingham. Each colony has been sprayed and looked after carefully, no increase being apparent during the year.

The scale has not been found in any of the nurseries. Some of the dealers have had scale on the trees sent to them from outside growers, but all such trees have been destroyed as soon as received.

I have some hopes of seeing the San Jose scale exterminated from the orchards of Michigan. During the year only two new cases of the scale were found, and these were soon destroyed, being confined to single trees.

Over one hundred orchards have been visited during the year, and, as stated before, only two infested places found.

I have been called twice during the year to settle disputes between yellows commissioners and the owners of orchards.

Many of the orchards of the State are badly infested with "canker worms." I have spent considerable time trying to get commissioners appointed to look after the spraying of these orchards, and have succeeded in getting a number appointed. Many farmers have not had good results from their spraying because they have not sprayed soon enough or thoroughly enough.

Inspection of the nurseries of the State has shown them to be without any indication of the presence of San Jose scale, or of its ever having been there. In some of them I have found "Black Aphis" on the roots of the peach, and "Woolly Aphis" on the stem and roots of the apple. In all of the above cases prompt action on the part of the owners has been taken, and the stock given proper treatment, my services in applying remedies being freely given.

During the year I inspected seventy-five nurseries, the stock of forty fruit growers and the premises of a number of dealers.

The railroad authorities have been very careful about handling stock not properly labeled, and I think that I have been notified by them of all shipments that have been received without the necessary certificate of inspection. Of fifty such notifications, forty-six were shipments from people having an inspector's certificate, the omission being due to carelessness or else the certificate was torn off during transportation. The remaining four were from parties not inspected.

The above, together with a large amount of clerical work, has taken all of my time.

Respectfully submitted,
D. W. TRINE,
Inspector.

Lansing, Mich., June 30, 1899.

NURSERYMEN.

The following is the list of Nurserymen and dealers who had licenses from June 30, 1898, to June 30, 1899:

Allen Nursery Co.	Rochester, New York.
Bowman & Son, Thos. W.	Rochester, New York.
Bragg & Co., L. G.	Kalamazoo, Michigan.
Buttrick & Watterson	Cascade, Michigan.
Brown Bros.	Rochester, New York.
Bogue, Nelson	Batavia, New York.
Babcock, Wm. C.	Bridgman, Michigan.
Baldwin, O. A. E.	Bridgman, Michigan.
Biglow, J. N.	Bangor, Michigan.
Central Michigan Nursery Co.	Kalamazoo, Michigan.
Chase Bros.	Rochester, New York.
Chase, R. G.	Geneva, New York.

Cole, W. B.	Painesville, Ohio.
Chase, W. D.	Geneva, New York.
Curtis, L. P.	Flint, Michigan.
Dunham, Enos W.	Stevensville, Michigan.
Davis & Schoolcraft	South Haven, Michigan.
Dean, Geo. N.	Shelbyville, Michigan.
Dressel Bros.	Hart, Michigan.
Ellwanger & Barry	Rochester, New York.
Essig, W. W.	Detroit, Michigan.
Fox & Son, John	Woodland, Michigan.
Flansburg & Peirson,	Leslie, Michigan.
Flemer & Felmly	Springfield, New Jersey.
Foot, O. C.	Ogden, Michigan.
Greening Bros.	Monroe, Michigan.
Gustin, C. F.	Adrian, Michigan.
Goodell, E. W.	Mayville, Michigan.
Havekost, Geo. H.	Monroe, Michigan.
Herrmann, H. A.	Monroe, Michigan.
Herbst, Wm. G.	Maybee, Michigan.
Hawley & Sons, E.	Hart, Michigan.
Hamilton, A.	Bangor, Michigan.
Hugueny, Hack & Co.	Monroe, Michigan.
Husted & Co., N. P.	Lowell, Michigan.
Ilgenfritz Sons, I. E.	Monroe, Michigan.
Jeffries, James	Kalamazoo, Michigan.
Joy & Scofield	Bloomingdale, Michigan.
Jaquay & Co., Irving	Benton Harbor, Michigan.
Kellogg, R. M.	Three Rivers, Michigan.
Knight & Bostwick	Newark, New York.
Lampson & Rood	Covert, Michigan.
Maile, Geo.	South Haven, Michigan.
Maudlin, E.	Bridgman, Michigan.
Michigan Nursery Co.	Monroe, Michigan.
Mason, A. W.	Palo, Michigan.
Nelson & Son, J. A.	Paw Paw, Michigan.
Nash, C. C.	Three Rivers, Michigan.
Northern Orchard & Nursery Co.	Augusta, Michigan.
Pickett, G. S.	Clyde, Ohio.
Patty, D. H.	Geneva, New York.
Prater, G. E.	Paw Paw, Michigan.
Peirson Bros.	Waterloo, New York.
Rose, W. F.	Moline, Michigan.
Rakestraw & Pyle	Willowdale, Pennsylvania.
Stewart & Co., C. W.	Newark, New York.
Speilman Bros.	Adrian, Michigan.
Sheldon & Son, P. B.	Albion, Michigan.
Sears, Henry & Co.	Geneva, New York.
Stone & Son, John	Hillsdale, Michigan.
Sweet & Co., John	Dansville, New York.
Van Dusen Co., The C. L.	Geneva, New York.
Van Auken & Forward	Diamond Loche, Michigan
West Michigan Nursery Co.	Benton Harbor, Michigan.
Weston & Co., A. R.	Bridgman, Michigan.
Wise, Ralph	Otsego, Michigan.
Whitten, C. E.	Bridgman, Michigan.
Wooll, I. A.	Elsie, Michigan.
Whitney & Co., G. W.	Dansville, New York.

DEALERS IN NURSERY STOCK.

Augustine, L. D.	St. Joseph, Michigan.
Archer & Co., Thos.	St. Joseph, Michigan.
Bailey, H. A.	Jackson, Michigan.
Barnes, T. W.	Stevensville, Michigan.

Ball Du Bois Nursery Co.	Saginaw, Michigan.
Bush, O. S.	Wayland, Michigan.
Brooke, F. W.	Ithaca, Michigan.
Ballard, S. T. F.	Coldwater, Michigan.
Bouske, A.	Marine City, Michigan.
Cross, J. A.	Spring Lake, Michigan.
Culver, O. B.	Colon, Michigan.
Close, B. F.	Harmonsburg, Pennsylvania.
Davis, S. B.	Jackson, Michigan.
Dow, H. C.	Bravo, Michigan.
DeBar, Pitt	Ithaca, Michigan.
Dickerman, H. J.	Benton Harbor, Michigan.
Dalzell, B. F.	Muir, Michigan.
Fairbanks, Z. C.	Traverse City, Michigan.
Filer, A. C.	Calumet, Michigan.
Green & Son, A. W.	Michigan Centre, Michigan.
Hill, Wilson	Davidson, Michigan
Higgins, Geo. D.	Otsego, Michigan.
Horton, D. D.	Greenville, Michigan.
Handy, F. V.	Avondale, Michigan.
Ilgenfritz & Co., E. C.	Monroe, Michigan.
Lewis, Geo. H.	Monroe, Michigan.
Ludwig, W. E.	Lake Odessa, Michigan.
Mosier, C. H.	Paw Paw, Michigan.
McVean, F. D.	Monteith, Michigan.
Nale, D. C.	Pontiac, Michigan.
Owen, R. B.	Battle Creek, Michigan.
Perry, J. W.	Birmingham, Michigan.
Person, O. S.	Howell, Michigan.
Pearson, O. S.	Grand Rapids, Michigan.
Grand Rapids Nursery Co.	Grand Rapids, Michigan
Pruyn, John	Grand Rapids, Michigan.
Pilkinton, S. H.	Portland, Michigan.
Perkins, H. D.	Grand Rapids, Michigan.
Stone, J. B.	Vermontville, Michigan.
Souter, Geo. H.	Holland, Michigan.
Thrasher, C. D.	Hamburg, Michigan.
Trask, F. M.	Williamston, Michigan.
Vicksburg Nursery Co.	Vicksburg, Michigan.
Wrisley, M. J.	Grand Rapids, Michigan.

SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL EXPERIMENT STATION FOR THE YEAR 1898.

IN CONTINUATION OF THE SAME SERIES OF OBSERVATIONS RECORDED FOR THE MICHIGAN AGRICULTURAL COLLEGE SINCE 1863.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY AND CHEMIST OF THE STATION.

Months, 1898.	Mean daily temperture in open air.	Percentage of humidity, saturation—100.	Pressure of vapor of water in air.	Height of barometer reduced to temperature of 32° F.	Percentage of cloudiness.	Self-registering thermometers.		Amount of rain or melted snow in inches.	Snow fall in inches.	Number of thunder storms.
						Maximum.	Minimum.			
January	26.21	94.9	.140	29.090	62	34.1	15.8	2.94	12.25	0
February	24.49	97.2	.142	29.121	65	32.6	15.9	1.74	11.25	0
March	37.56	88.9	.218	29.180	55	47.2	27.7	3.61	0	0
April	44.37	83.2	.252	29.134	46	55.0	32.1	2.08	1.50	1
May	58.37	86.2	.438	29.044	41	68.5	45.3	2.15	0	4
June	69.19	86.4	.624	29.096	34	80.3	55.0	4.44	0	0
July	73.01	81.6	.676	29.160	15	84.7	55.4	1.10	0	2
August	70.45	87.1	.652	29.125	36	81.6	57.6	2.73	0	0
September	63.58	85.8	.521	29.135	32	75.6	51.0	3.00	0	3
October	50.43	90.8	.356	29.122	65	58.4	40.9	3.54	0	0
November	34.40	93.9	.191	29.161	61	41.0	25.5	2.72	13.50	0
December	25.99	99.6	.144	29.121	65	30.1	18.0	1.67	5.75	0
Year	48.17	89.6	.363	29.124	48	57.4	36.7	31.72	44.25	10

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	2	14	18	11⅓	100	100	84	.048	.082	.082	29.279	29.312	29.316	29.302
2	14	20	22	18⅔	100	100	86	.082	.108	.101	29.143	28.845	28.899	28.962
3	17	28	22	22⅓	83	100	100	.078	.153	.118	29.120	29.139	29.089	29.116
4	18	32	29	26⅓	100	89	100	.098	.162	.160	28.951	28.971	29.144	29.022
5	18	38	24	26⅔	84	91	87	.082	.208	.117	29.230	29.154	29.082	29.155
6	32	35	34	33⅔	100	90	89	.181	.183	.175	28.869	28.830	29.044	28.914
7	19	35	37	30⅓	100	100	71	.103	.204	.157	29.180	29.048	28.685	28.971
8	34	35	19	29⅓	79	80	100	.155	.162	.103	28.759	28.908	29.098	28.922
9	22	38	34	31⅓	100	100	79	.118	.229	.155	29.074	28.944	28.971	28.996
10	27	37	27	30⅓	100	71	100	.147	.157	.147	29.140	29.178	29.249	29.189
11	22	36	35	31	100	80	100	.118	.170	.204	29.117	28.990	28.890	28.999
12	40	47	37	41⅓	100	100	100	.248	.323	.221	28.687	28.575	28.663	28.642
13	30	30	26	28⅔	100	100	87	.167	.167	.123	29.058	29.107	29.210	29.125
14	20	30	30	26⅔	100	100	100	.123	.167	.167	29.267	29.247	29.117	29.210
15	28	30	26	28	100	100	87	.153	.167	.123	28.888	28.866	29.069	28.941
16	18	27	22	22⅓	100	100	100	.098	.147	.118	29.202	29.265	29.289	29.252
17	13	32	26	23⅔	100	89	100	.078	.162	.141	29.332	29.316	29.403	29.350
18	13	37	26	25⅓	100	71	100	.078	.157	.141	29.406	29.436	29.468	29.436
19	20	40	26	28⅔	100	73	100	.108	.182	.141	29.375	29.229	29.049	29.218
20	35	37	32	34⅔	100	71	100	.204	.157	.181	28.509	28.497	28.989	29.665
21	33	29	33	31⅔	89	100	100	.168	.160	.188	29.219	29.247	29.239	29.235
22	32	34	33	33	100	89	89	.181	.175	.168	29.192	29.032	28.448	28.891
23	32	30	26	29⅓	100	100	100	.181	.167	.141	28.375	28.841	29.154	28.790
24	4	30	26	20	73	89	100	.038	.148	.141	29.257	29.304	29.260	29.274
25	26	26	30	27⅓	100	100	89	.141	.141	.148	28.987	28.633	28.706	29.109
26	26	29	17	24	100	100	100	.141	.160	.094	29.013	29.052	29.030	29.032
27	20	26	7	17⅔	100	100	100	.108	.141	.060	29.006	29.052	29.194	29.084
28	20	31	23	24⅔	100	100	86	.108	.174	.106	28.888	28.795	29.013	28.899
29	20	21	5	15⅓	100	100	100	.108	.113	.055	29.223	29.259	29.287	29.263
30	11	26	26	21	100	100	100	.071	.141	.141	29.192	29.005	28.783	28.993
31	24	20	10	18	100	100	100	.129	.108	.068	28.692	28.833	29.163	28.896
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	26.21	97.0	93.0	94.6	.121	.164	.135	--------	--------	--------	29.090
Average	------	------	------	------	94.9			.140			--------	--------	--------	--------

JANUARY, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds. 7 A. M. Per cent of cloud.	Clouds. 7 A. M. Kind.	Clouds. 2 P. M. Per cent. of cloud.	Clouds. 2 P. M. Kind.	Clouds. 9 P. M. Per cent of cloud.	Clouds. 9 P. M. Kind.	Winds. 7 A. M. Direction.	Winds. 7 A. M. Force.	Winds. 2 P. M. Direction.	Winds. 2 P. M. Force.	Winds. 9 P. M. Direction.	Winds. 9 P. M. Force.	Registering thermometer. Maximum.	Registering thermometer. Minimum.	Rain and snow. Beginning, rain or snow.	Rain and snow. Ending, rain or snow.	Rain and snow. Inches of rain or melted snow.	Rain and snow. Depth of snow, inches.
----	----	----	----	----	----	e	5	n e	8	n e	6	18	2	----	----	----	----
70	Cir.	100	Cir.	60	Cir.	s	16	s w	17	s w	2	22	10	----	----	----	----
60	Cir.	40	Cir.	100	Cir.	s w	1	s w	1	s w	7	31	16	----	----	----	----
60	Cir.Str.	50	Cir.	80	Cir.	----	0	s w	9	s w	2	34	17	----	----	----	----
20	Str.	----	----	----	----	s w	3	s w	6	s w	6	40	17	----	----	----	----
90	Cir. Cu.	100	Cir.	50	Cir.	s w	8	w	11	w	1	38	19	----	----	----	----
----	----	60	Cir.	50	Cir.	w	1	w	7	w	10	39	19	----	----	----	----
60	Cir.	20	Cir.	----	----	w	11	w	11	----	0	36	16	----	----	----	----
----	----	80	Cu.	100	Nim.	----	0	w	8	n w	1	39	22	6 p. m.	8 p. m.	‡	----
20	Cir.	60	Cir.	----	----	n w	2	w	3	s w	1	36	19	----	----	----	----
100	Cir.	100	Nim.	100	Cir.	s w	3	s	5	s	4	40	21	Night.	----	----	----
100	Nim.	100	Nim.	100	Cir.	s	5	s	7	w	6	54	30	----	12 m.	.60	----
100	Cir.	100	Cir.	100	Cir.	n w	1	n w	6	n w	7	32	20	----	----	----	----
----	----	80	Cir.	100	Cir.	n w	1	n w	7	n	3	34	25	----	----	----	----
100	Nim.	100	Cir.	100	Cir.	e	4	n	4	e	2	32	15	† 5 a. m.	7 a. m.	----	.5
80	Cir.Str.	80	Cir.	100	Cir.	s e	1	s	4	----	0	30	13	----	----	----	----
----	----	----	----	----	----	----	0	s w	7	----	0	36	13	----	----	----	----
----	----	----	----	----	----	----	0	s w	5	s w	3	38	13	----	----	----	----
----	----	80	Cir.	100	Cir.	s e	3	s e	4	----	6	40	19	Night.	----	----	----
100	Nim.	100	Nim.	100	Cir.	s e	6	s e	10	s w	5	40	32	----	10 a. m.	.77	----
100	Cir.	100	Nim.	100	Cir.	s w	8	s w	7	s w	3	34	31	----	----	----	----
100	Cir.	100	Nim.	100	Nim.	----	0	n e	3	n e	7	34	32	† 12 m	----	----	----
100	Nim.	100	Nim.	100	Cir.	w	16	w	----	w	----	34	4	----	12 m.	.80	4.0
----	----	----	----	----	----	w	----	w	2	w	7	35	4	----	----	----	----
100	Cir.	100	Nim.	100	Nim.	n e	6	n e	8	n e	6	31	23	† 11.30 am.	7:10 p m	.77	7.0
100	Cir.	60	Cir.	----	----	n e	6	n e	10	n e	8	31	13	----	----	----	----
100	Nim.	30	Cir.	----	----	w	8	n	10	n	6	31	4	† 6 a m	8 a. m.	‡	----
100	Nim.	100	Nim.	100	Nim.	s	9	s	10	n w	7	36	17	----	----	----	----
20	Cir.	40	Cir.	----	----	n w	5	n w	2	n w	3	27	—2	----	----	----	----
80	Cir.	60	Cir.	100	Nim.	e	1	e	10	e	7	30	11	† 6 p m	Night	----	.75
40	Cir.	100	Cir.	60	Cir.	n w	12	n w	15	n w	4	23	—6	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.94	12.25
58	----	66	----	61	----	----	----	----	----	----	----	34.1	15.8	----	----	----	----
62						----	----	----	----	----	----	----	----	----	----	----	----

† Snow. ‡ Trace.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer, in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	6	0	0	2	100	100	100	.033	.044	.044	29.338	29.253	29.248	29.280
2	6	10	3	4⅓	100	100	100	.057	.068	.050	29.024	29.063	29.307	29.131
3	3	11	7	5	100	100	100	.038	.071	.060	29.287	29.205	29.264	29.252
4	12	32	33	25⅔	100	79	80	.075	.143	.150	29.232	29.153	29.013	29.133
5	34	36	6	25⅓	71	54	100	.138	.115	.057	28.966	29.160	29.503	29.210
6	3	31	27	18⅓	100	100	100	.050	.174	.147	29.440	29.320	29.233	29.331
7	23	40	37	33⅓	100	91	100	.123	.225	.221	29.228	29.214	29.188	29.210
8	36	44	38	39⅓	100	100	100	.212	.229	.289	29.188	29.219	29.246	29.218
9	36	44	39	39⅔	100	100	100	.212	.289	.238	29.233	29.233	29.272	29.246
10	36	45	45	42	100	100	100	.212	.300	.300	29.288	29.235	29.139	29.221
11	44	46	32	40⅔	100	100	100	.289	.311	.181	28.999	28.939	29 069	29.002
12	32	36	25	31	100	100	100	.181	.212	.138	29.156	29.242	29.333	29.244
13	33	40	40	37⅔	80	100	82	.150	.248	.203	29.284	29.086	28.848	29.073
14	26	32	30	29⅓	100	79	100	.141	.143	.167	28.970	28.950	28 762	28.894
15	24	22	14	20	100	100	100	.129	.118	.082	28.692	28.852	29.060	28.868
16	0	14	11	8⅓	100	100	100	.044	.082	.071	29.229	29.290	29.279	29.266
17	22	29	38	29⅔	100	100	72	.123	.160	.165	29.130	29.024	28.979	29.044
18	33	32	26	30⅓	89	100	100	.168	.181	.141	29.102	29.206	29.348	29.219
19	25	30	30	28⅓	100	100	100	.135	.167	.167	29.312	29.198	28.956	29.155
20	31	30	24	28⅓	100	89	100	.174	.148	.129	28.870	28.868	28.940	28.893
21	20	20	20	20	100	100	100	.108	.108	.108	28.928	28.809	28.929	28.889
22	22	29	24	25	100	100	100	.118	.160	.129	28.920	28.893	28.935	28.916
23	24	30	29	27⅔	100	100	100	.129	.167	.160	28.927	28.887	28.876	28.897
24	17	23	17	19	100	100	100	.094	.123	.094	28.876	28.926	29.016	28.939
25	15	28	17	20	100	100	100	.086	.153	.094	29.030	29.093	29.233	29.119
26	20	29	24	24⅓	100	100	100	.108	.160	.129	29.256	29.289	29.309	29.285
27	22	28	11	20⅓	100	100	100	.118	.153	.071	29.332	29.306	29.274	29.304
28	0	28	16	14⅔	100	100	100	.044	.153	.090	29.200	29.141	29.092	29.144
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	24.49	97.9	96.1	97.5	.125	.164	.138	--------	--------	--------	29.121
Average	------	------	------	------	97.2			.142			--------	--------	------	--------

FEBRUARY, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
----	--------	----	--------	----	--------	n w	2	n w	3	n w	3	11	—6	--------	--------	-----	-----
60	Cir.	50	Cu.	60	Cir.	s w	2	n w	3	n w	3	14	—10	--------	--------	-----	-----
50	Cir.Str.	60	Cir.	50	Cir.	s w	3	s w	3	s w	3	12	—10	--------	--------	-----	-----
60	Str.	60	Str.	100	Nim.	s w	3	s w	9	s w	11	35	—4	8:00 p.m.	--------	-----	-----
100	Nim.	80	Cir.	----	--------	s w	10	s w	7	s w	1	35	14	--------	7 a. m.	-----	.50
----	--------	----	--------	60	Cir.	s w	2	s e	8	s e	2	35	27	--------	--------	-----	-----
50	Cu.Str.	80	Cu.	20	Cir.	s e	2	s e	5	s e	5	44	17	--------	--------	-----	-----
80	Cir.	100	Cir.	100	Cir.	s e	3	s w	3	s w	3	47	33	--------	--------	-----	-----
100	Cir.	100	Cir.	100	Cir.	s w	3	s w	2	----	0	46	36	In night	--------	-----	-----
100	Nim.	100	Cir.	----	--------	s w	1	s w	4	s e	8	49	36	--------	7 a. m.	.19	-----
20	Str.	100	Nim.	100	Cir.	s e	10	s e	6	s w	6	50	36	--------	--------	-----	-----
100	Nim.	80	Cir.	----	--------	s w	6	w	9	s w	4	40	25	In night	Snow	Trace.	-----
100	Cir.	----	--------	100	Nim.	s w	8	s w	11	s w	11	42	26	*In night	--------	-----	-----
80	Cir.	80	Cir.	100	Nim.	w	9	s w	7	w	2	34	24	5:00 p.m.	--------	.03	.25
100	Nim.	90	Cu.	----	--------	n e	10	n	9	n	----	24	11	--------	9 a. m.	.25	2½
----	--------	----	--------	----	--------	n	----	n	2	n	11	24	—1	--------	--------	-----	-----
100	Nim.	80	Cir.	100	Nim.	s e	15	s e	16	s w	3	40	11	In night	--------	-----	-----
100	Nim.	60	Cir.	----	--------	s w	3	n e	5	n e	6	34	25	--------	7 a. m.	-----	-----
100	Cir.	100	Nim.	100	Nim.	n e	5	n e	6	n e	4	32	24	* 7 p.m.	Innight	.52	.50
100	Cir.	100	Nim.	100	Nim.	n e	6	n e	4	n e	9	31	24	† 2 p. m.	--------	-----	-----
100	Nim.	100	Nim.	100	Cir.	n e	6	n e	8	n e	5	24	20	--------	12 m.	.70	7
100	Cir.	100	Cir.	100	Nim.	n e	3	s w	3	s w	3	30	21	In night	--------	.05	.5
100	Nim.	100	Nim.	100	Nim.	s e	5	s w	8	s w	5	33	13	--------	--------	-----	-----
100	Cir.	100	Nim.	----	--------	s w	5	s w	6	s w	2	23	15	--------	--------	-----	-----
40	Cir.Str.	100	Cir.	----	--------	s w	1	s w	5	----	0	29	13	--------	--------	-----	-----
----	--------	100	Cir.	100	Cir.	s w	1	s w	1	n	1	29	16	--------	--------	-----	-----
100	Cir.	100	Cir.	----	--------	n	1	n w	2	----	0	33	11	--------	--------	-----	-----
----	--------	----	--------	----	--------	----	0	n w	4	n	4	32	—2	--------	--------	-----	-----
----	--------	----	--------	----	--------	----	----	----	----	----	----	-----	-----	--------	--------	1.74	11.25
69	--------	72	--------	53	--------	----	----	----	----	----	----	32.6	15.9	--------	--------	-----	-----
65						----	----	----	----	----	----	-----	-----	--------	--------	-----	-----

* Rain and snow. † Snow.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF MARCH,

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	22	31	23	25⅓	100	100	100	.118	.174	.123	29.048	29.036	29.138	29.074
2	22	31	22	25	100	100	100	.118	.174	.123	29.157	29.146	29.327	29 210
3	6	36	24	22	100	80	100	.057	.170	.129	29.346	29 329	29.300	29.325
4	21	34	12	22⅓	100	79	100	.113	.155	.075	29.294	29.304	29.386	29.328
5	4	36	23	21	100	71	100	.052	.149	.123	29.417	29.437	29.429	29.428
6	24	46	32	34	100	84	100	.129	.262	.181	29.449	29.445	29 420	29.438
7	22	50	31	34⅓	100	100	65	.118	.234	.174	29.389	29.378	29.358	29.375
8	28	56	43	42⅓	100	81	83	.153	.363	.231	29.322	29.258	29.149	29.243
9	42	58	46	48⅔	83	70	84	.222	.337	.262	29.120	29.059	29.074	29.084
10	45	39	39	41	100	100	100	.300	.238	.238	29.110	29.159	29.159	29.143
11	47	50	37	44⅔	85	100	100	.273	.361	.221	28.994	28.870	28.946	28.937
12	33	38	33	34⅔	100	100	100	.188	.229	.188	28.984	28.936	28 796	28.905
13	31	39	35	35	100	73	100	.174	.173	.204	28.733	29 010	29.200	28.981
14	30	46	35	37	100	69	70	.167	.215	.142	29 329	29.342	29.320	29.330
15	33	38	39	36⅔	80	81	100	.150	.186	.238	29.116	29.043	29.010	29.056
16	37	68	51	52	100	51	86	.221	.349	.321	29.110	28.977	28.974	29.020
17	37	49	32	39⅓	100	57	100	.221	.199	.181	29.197	29.236	29.292	29.242
18	34	45	42	40⅓	89	84	100	.175	.251	.267	29.214	29.116	28.970	29.100
19	55	54	42	50⅓	100	93	100	.433	.390	.267	28.802	28.811	29.005	28.873
20	32	48	41	40⅓	100	78	100	.181	.260	.257	29.234	29.239	29.101	29.191
21	46	49	43	46	100	96	92	.311	.329	.254	29.071	29.094	29.051	29.072
22	55	64	38	52⅓	100	77	91	.433	.464	.208	28.841	28.781	28.791	28.804
23	26	32	32	30	100	79	89	.141	.143	.162	29.124	29.200	29.246	29.190
24	27	42	28	32⅓	100	66	88	.147	.177	.135	29.249	29.237	29.312	29.266
25	32	54	43	43	69	74	92	.125	.308	.254	29.394	29.384	29.363	29.380
26	43	49	54	48⅔	92	100	93	.254	.348	.390	29.309	29.264	29.222	29.265
27	54	60	58	57⅓	93	100	100	.390	.518	.483	28.997	28.901	28.880	28.926
28	33	34	33	33⅓	70	71	80	.131	.138	.150	29.155	29.186	29.279	29.173
29	30	38	28	32	78	100	100	.130	.229	.153	29.467	29.467	29 448	29.461
30	29	35	31	31⅔	88	70	100	.142	.142	.174	29.454	29.406	29.353	29.404
31	27	38	29	31⅓	88	54	100	.129	.123	.160	29.385	29.334	29.363	29.361
Sums														
Means				37.56	94.0	78.7	94.0	.190	.251	.212				29.180
Average					88.9			.218						

1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cir.	100	Cir.	----	--------	w	6	s w	5	s w	1	31	16	--------	--------	------	------
80	Cir.	80	Cir.	----	--------	s	3	s	4	s	----	33	20	--------	--------	------	------
----	--------	----	--------	----	--------	s	----	s w	----	s w	----	32	4	--------	--------	------	------
60	Str.	----	--------	----	--------	s w	----	s w	5	s w	1	31	12	--------	--------	------	------
----	--------	----	--------	----	--------	s w	1	s w	9	----	0	37	4	--------	--------	------	------
----	--------	15	Cir.	----	--------	s w	1	s w	1	s	1	46	18	--------	--------	------	------
----	--------	25	Cir.	----	--------	----	0	s	----	s	----	52	20	--------	--------	------	------
----	--------	80	Cir.	60	Cir.	s	----	s	4	s	3	56	25	--------	--------	------	------
80	Cir.	60	Cir.	10	Cir.	s	10	s	8	s	9	61	28	--------	--------	------	------
100	Nim.	100	Nim.	100	Cir.	s	5	----	0	se	8	48	38	EarlyMo.	2 p. m.	.45	------
100	Nim.	100	Nim.	100	Cir.	s w	7	s w	17	s w	2	51	37	7 a. m.	8 p. m.	.15	------
100	Cir.	100	Cir.	100	Nim.	se	2	se	2	e	3	41	31	6 p. m.	§	------	------
100	Nim.	100	Cir.	100	Cir.	w	14	w	15	----	0	39	31	--------	7 a. m.	.72	------
----	--------	----	--------	----	--------	w	1	se	5	e	9	48	28	--------	--------	------	------
60	Str.	100	Cir.	----	--------	e	12	e	16	e	2	44	30	*	¶	.46	------
----	--------	----	--------	----	--------	s w	4	s w	18	w	6	69	37	--------	--------	------	------
----	--------	30	Cir.	----	--------	w	9	s w	9	s w	2	49	31	--------	--------	------	------
100	Cu.Str.	100	Nim.	100	Nim.	se	1	se	1	s w	8	55	28	**	‖	.62	------
100	Nim.	100	Cu.	100	Cir.	s w	10	s w	16	w	4	67	37	†	--------	.03	------
20	Cir.	100	Cu.	100	Cir.	w	5	s w	7	s w	9	48	29	In night.	--------	.28	------
100	Nim.	50	Cu.	100	Nim.	s w	4	s w	4	s	10	55	36	In night.	--------	.08	------
100	Cir.	80	Cu.	100	Cir.	s	10	s w	12	n	6	66	38	--------	--------	------	------
100	Cir.	80	Cir.	40	Cir.	n	3	n w	3	n	1	33	24	--------	--------	------	------
20	Str.	30	Cir.	----	--------	s	5	s w	9	----	0	46	21	--------	--------	------	------
----	--------	20	Cir.	----	--------	----	0	s	10	s	8	55	24	--------	--------	------	------
100	Cu.	100	Cu.	100	Cu.	s	10	s	14	s	9	54	35	‡	--------	.54	------
100	Cu.	100	Cu.	100	Cu.	se	15	s	14	s w	16	60	50	1:45 p.m.	6:30 p m	.28	------
100	Cu.	100	Cu.	90	Cu.	s w	16	s w	13	s w	7	34	26.5	--------	--------	------	------
20	Cu.	----	--------	----	--------	w	6	n w	12	n w	1	43	26	--------	--------	------	------
60	Cir.	80	Cir.	----	--------	n	3	n w	5	n	2	37	22	--------	--------	------	------
80	Str.	----	--------	----	--------	n	3	n w	7	n w	1	43	21	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	3.61	------
57	--------	60	--------	48	--------	----	----	----	----	----	----	47.2	27.7	--------	--------	------	------
55						----	----	----	----	----	----	------	------	--------	--------	------	------

* { 10:30 a. m.
  4:30 p. m.

** { 12:30 p. m.
  7 p. m.

† Shower noon.

‡ P. M. and night.

‖ { 1:30 p. m.
  8 a. m.

¶ { 12 noon.
  7:30 p. m.

§ Changed to snow.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	31	33	31	31⅔	100	80	100	.174	.150	.174	29.366	29.304	29 217	29 296
2	25	33	21	26⅓	100	80	100	.135	.150	.113	29.224	29.217	29.262	29 234
3	23	38	27	29⅓	86	63	100	.106	.144	.147	29.318	29.214	29.166	29.234
4	24	34	16	24⅔	86	89	100	.111	.175	.090	29.193	29.224	29.350	29.256
5	22	37	29	29⅓	86	71	100	.101	.157	.160	29.345	29.337	29.322	29.335
6	30	34	31	31⅔	89	79	100	.148	.155	.174	29.314	29.308	29.352	29.325
7	30	46	32	36	78	77	100	.130	.238	.181	29.446	29.431	29.400	29.426
8	38	57	46	47	45	69	69	.103	.322	.215	29.392	29.298	29.168	29.286
9	44	52	39	45	84	86	55	.241	.334	.131	29.071	28.997	29.079	29 049
10	44	54	39	45⅔	84	74	91	.241	.308	.216	29.170	29.205	29.278	29.218
11	44	66	44	51⅓	68	49	68	.196	.316	.196	29.393	29.388	29.394	29.392
12	44	68	45	52⅓	76	56	100	.218	.380	.300	29.432	29.328	29.159	29.306
13	44	65	45	51⅓	92	41	76	.265	.301	.228	28.958	28.814	28.785	28.852
14	45	61	45	50⅓	84	61	92	.251	.325	.275	28.754	28.769	28.883	28.802
15	45	65	46	52	68	53	92	.204	.330	.286	28.969	28.952	28.979	28.967
16	47	70	52	56⅓	77	61	86	.249	.449	.348	29.051	28.899	28.913	28.954
17	51	61	44	52	86	61	100	.321	.325	.289	29.008	29.020	29.167	29.065
18	39	52	39	43⅓	100	53	91	.238	.208	.216	29.257	29.233	29 144	29.211
19	43	49	39	43⅔	100	100	91	.278	.348	.216	28.765	28.667	28.781	28.768
20	37	44	38	39⅔	90	92	100	.199	.265	.229	28.823	28.871	29.040	28.911
21	43	56	47	48⅔	83	69	85	.231	.308	.273	29.139	29.139	29.145	29.141
22	46	54	51	50⅓	100	100	100	.311	.418	.374	29.040	28.923	28 940	28.968
23	44	47	41	44	100	100	100	.289	.323	.257	29.014	29.019	29.003	29.012
24	45	55	42	47⅓	84	87	100	.251	.376	.267	29.004	29.049	29.069	29.041
25	43	44	42	43	83	84	91	.231	.241	.244	29.095	29.184	29.234	29.171
26	43	60	41	48	83	100	100	.231	.518	.257	29.340	29.329	29.349	29 339
27	40	62	46	52	85	77	84	.285	.429	.262	29 324	29.276	29.177	29.259
28	51	57	46	51⅓	86	75	84	.321	.350	.262	28.929	28.960	28.930	28.940
29	47	61	44	50⅔	85	66	92	.273	.354	.265	28.952	29.014	29.149	29.038
30	53	64	53	56⅔	80	57	80	.321	.343	.321	29.267	29.276	29.197	29.247
Sums	------	------	------	------	------	------	------	----	------	------	--------	------	--------	--------
Means	------	------	------	44.37	84.9	73.7	90.9	.222	.301	.232	--------	--------	--------	29.134
Average	------	------	------	------	83.2			.252			-------	--------	--------	--------

APRIL, 1899, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN,

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
60	Cir.	100	Nim.				0	s e	2	s e	1	39	25	*	6 p. m.	.21	1½
20	Cir.					n w	2	n w	11	n w	2	37	19				
						n w	1	w	10	w	2	40	15				
		80	Cu.	30	Cir.	e	5	e	4	n e	3	31	16				
60	Cir. Str.	60	Cu.			n w	4	n e	3	n e	2	37	16				
50	Cir.	85	Cu.			n e	5	n e	4	n w	1	40	21	†			
						n w	2	e	2		0	50	22				
		50	Cir.	50	Cir.	s	4	s w	2	s e	2	58	22				
100	Nim.	100	Cu.			s e	2	s e	1		0	54	38	Rain.		Trace.	
100	Cu.	80	Cu.			s e	2	s e	3	s	1	58	37				
						s	1	s w	3	s w	1	66	30				
20	Cir.					s w	1	s w	5		0	69	30				
60	Cir.	50	Cir.	80	Cir.	s w	5	s e	3	e	2	66	36				
40	Cir.	40	Cir.			e	3	s e	11	e	5	63	41				
				60	Cir.	n e	4		0		0	67	39				
100	Nim.	80	Cu.			n w	3	s w	15	n e	1	73	32	7:30 a m	9:00 a m	Trace.	
20	Cir.			100	Nim.	n	1	n	4	n e	2	62	43	7:30 p m	In night	.11	
100	Cu.	100	Cu.	100	Nim.	n e	2	e	5	e	8	54	38	5 p. m.			
100	Nim.	100	Cu.	100	Cu.	e	7	n w	14	n w	3	50	37		11 a. m.	.83	
100	Nim.	100	Cu.Nim			n w	6	w	3	w	2	56	34	In night		Trace.	
		60	Cir.	80	Cir.		0	w	6	s w	5	56	34	In night			
100	Nim.	100	Nim.	100	Nim.	s	1	s w	3	s w	2	56	44		8 p. m.	.54	
100	Nim.	100	Cu.	80	Cir.	e	3	n e	2	n e	1	49	41				
70	Cu.	100	Cu.	10	Cir.		0	n e	9	n e	1	58	38				
100	Cu.	100	Nim,	100	Nim.		0	n		n		46	38	12 Noon.	8 p. m.	.27	
		20	Cu.			n e	4	n e	5		0	61	36				
						n e	2	s	4		0	64	28				
50	Cir.	100	Cu.	100	Nim.		0	s e		s w		59	37	‡6 p. m.	In night	.12	
10	Cir.			20	Cir.	n w		n w		n w		64	42				
		80	Cu.	100	Cu.	s e	3	s e	10		0	67	34	In night			
																2.08	1.5
45		56		37								55	32.1				
46																	

Snow at 12:30 p. m. † Snow flurries. ‡ Rain.

METEOROLOGICAL OBSERVATIONS, FOR THE MONTH OF

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	52	61	57	56⅔	86	94	100	.334	.505	.466	29.119	20.003	28.970	29.031
2	57	70	53	60	100	100	93	.466	.733	.375	28.968	28.883	28.999	28 950
3	46	57	44	47	84	69	50	.262	.308	.175	29.134	29.158	29.209	29 167
4	39	45	42	42	86	84	83	.210	.251	.222	29.265	29.255	29 223	29.248
5	43	48	36	42⅓	83	78	80	.231	.260	.170	29.150	29.096	29.138	29.128
6	43	55	38	45⅓	83	81	72	.231	.349	.165	29.161	28 993	29.056	29.070
7	57	68	48	57⅔	69	88	100	.322	.491	.335	29 003	28.984	29 009	28.999
8	60	71	51	60⅔	65	66	100	.338	.503	.374	29 090	29.102	29.098	29.097
9	59	75	62	65⅓	70	68	77	.352	.591	.429	29.134	29.089	29 057	29 093
10	55	63	48	55⅓	100	83	100	.433	.478	.335	29.010	28.983	28.962	28.985
11	57	64	43	54⅔	87	62	100	.407	373	.278	28.879	28.849	28.930	28 886
12	48	58	41	49	92	76	100	.310	.365	.257	28.990	29.017	29.119	29.042
13	53	67	51	57	93	95	100	.375	.626	.374	29.147	29.135	29.145	29.142
14	44	67	55	55⅓	100	95	100	.289	.626	.433	29.155	29.098	29.070	29.108
15	57	70	55	60⅔	100	100	100	.466	.733	.433	29.073	29.061	29.073	29.069
16	57	65	45	55⅔	94	73	92	.436	.451	.275	29.109	29.132	29.217	29.153
17	47	65	49	53⅔	92	68	92	.298	.420	.322	29.274	29.252	29.207	29.244
18	59	67	67	64⅓	70	89	84	.352	.529	.556	29.075	28.908	28.841	28.941
19	67	72	62	67	84	81	100	.556	.631	.556	28.799	28.830	28.891	28.840
20	60	70	58	62⅔	88	90	88	.456	.658	.423	28.972	28.991	29.089	29.017
21	67	73	69	69⅔	100	90	90	.662	.732	.635	29.099	29.056	29.050	29.068
22	69	73	60	67⅓	85	72	94	.599	.581	.487	29.061	29.010	29.025	29.032
23	64	73	61	66	83	67	94	497	545	.505	29.008	28.980	29.002	28.997
24	63	73	63	66⅓	83	77	73	.478	.617	.478	29.008	29.040	29.116	29.055
25	63	69	50	60⅔	83	85	100	.478	.599	.361	29.187	29.189	29.169	29.182
26	57	72	55	61⅓	87	66	100	.407	.524	.433	29.124	29.012	28.971	29.036
27	63	79	61	67⅔	83	66	94	.478	.651	.505	28.983	28.861	28.764	28.869
28	67	67	51	61⅔	89	89	100	.591	.591	.374	28.735	28.721	28.849	28.768
29	55	64	49	56	87	89	100	.407	.529	.348	28.909	28.902	28.968	28.926
30	54	62	55	57	100	72	94	.418	.399	.405	29 049	29.083	29.119	29.084
31	57	74	60	63⅔	87	63	94	.407	.532	.487	29.176	29.165	29.108	29.150
Sums														
Means				58.37	87	79.9	91.7	.405	.522	.386				29.014
Average					86.2			.438						

MAY, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Nim.	100	Nim.	20	Cir.	----	0	se	3	s	2	66	49	12:30 p m	6 p. m.	.20	----
100	Cir.	80	Nim.	10	Cu.	se	5	sw	18	w	8	74	51	2:30 p m	p. m.	.10	----
100	Cir. Str.	100	Cir. Str.	100	Cir. Str.	nw	8	nw	9	nw	4	51	37	----	----	----	----
100	Cir. Str.	100	Cir. Str.	80	Cir. Str.	ne	4	ne	4	ne	4	45	37	----	----	----	----
100	Cu.	100	Cu.	10	Str.	ne	3	ne	4	ne	3	48	35	----	----	----	----
10	Cu.	10	Cu.	5	Str.	ne	6	ne	9	ne	2	60	30	----	----	----	----
----	----	20	Cir.	----	----	ne	7	ne	11	----	0	69	32	----	----	----	----
----	----	----	----	----	----	e	3	ne	6	e	2	71	37	----	----	----	----
----	----	----	----	100	Cu.	sw	8	sw	8	sw	4	76	39	In night.	In night.	.12	----
100	Cu.	100	Cu.	----	----	sw	7	s	12	s	9	67	47	In night.	In night.	.05	----
30	Cir.	----	----	----	----	s	12	sw	17	sw	1	67	42	----	----	----	----
----	----	40	Cir.	----	----	w	4	nw	9	----	0	61	34	----	----	----	----
20	Cir.	80	Cu.	----	----	sw	4	sw	8	sw	2	67	34	----	----	----	----
100	Cir.	----	----	100	Nim.	n	1	w	3	w	1	69	34	In night.	Innignt.	.02	----
60	Cir.	60	Cu.	80	Cu.	e	2	w	5	n	2	70	50	----	----	----	----
60	Cir.	65	Cir.	----	----	sw	8	w	----	n	----	68	45	----	----	----	----
----	----	----	----	----	----	ne	----	ne	2	se	9	67	34	----	----	----	----
80	Cu.	80	Cu.	100	Nim.	se	12	s	8	s	15	73	45	8 a. m.	9 a. m.	.24	----
100	Cu.	40	Cu.	20	Cu.	s	----	sw	12	s	1	74	55	In night.	In night.	.9	----
100	Nim.	80	Cu.	80	Cu.	ne	5	ne	4	ne	2	73	56	8:30	10:00	.19	----
100	Cu.	40	Cu.	100	Cu.	se	9	sw	11	sw	9	80	56	----	----	----	----
40	Cu.	100	Cu.	20	Cir.	sw	13	sw	10	sw	6	74	60	----	----	----	----
40	Cu.	----	----	----	----	w	9	w	13	w	1	74	59	----	----	----	----
20	Cir.	40	Cu.	80	Cu.	n	4	nw	4	n	1	74	60	----	----	----	----
----	----	----	----	----	----	ne	3	ne	4	----	0	73	49	----	----	----	----
----	----	30	Cir.	----	----	----	0	ne	1	ne	1	74	48	----	----	----	----
----	----	----	----	20	Cir.	se	6	se	8	s	7	78	60	In night.	In night.	----	----
----	----	100	Cu.	100	Cir.	s	7	sw	8	w	4	74	51	Showers.	9 a. m.	.33	----
20	Cir.	60	Cu.	----	----	nw	5	nw	6	nw	2	67	49	----	----	----	----
----	----	----	----	----	----	nw	3	nw	3	----	0	65	49	----	----	----	----
----	----	----	----	----	----	nw	2	se	8	se	2	74	40	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.15	----
44.5	----	46	----	33.1	----	----	----	----	----	----	----	68.5	45.3	----	----	----	----
41.						----	----	----	----	----	----	----	----	----	----	----	----

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	67	69	62	66	75	90	100	.489	.635	.556	29.049	29.046	28.991	29.029
2	67	79	55	67	75	69	100	.489	.691	.433	29.112	29.148	29.198	29.153
3	60	82	57	66⅓	88	63	100	.456	.691	.466	29.249	29.267	29.299	29.272
4	69	86	63	72⅔	85	65	94	.599	.805	.543	29.325	29.297	29.338	29.320
5	74	86	66	75⅓	81	76	89	.680	.942	.570	29.289	29.250	29.247	29.262
6	64	85	67	72	89	68	100	.529	.819	.662	29.244	29.201	29.171	29.205
7	74	90	68	77⅓	81	60	90	.680	.841	.612	29.181	29.120	29.103	29.135
8	69	76	61	68⅔	95	91	100	.671	.812	.537	29.043	29.023	29.080	29.049
9	69	80	66	71⅔	85	70	100	.599	.717	.639	29.133	29.134	29.141	29.136
10	64	81	66	70⅓	94	74	100	.563	.787	.639	29.099	29.059	28.977	29.045
11	73	81	66	73⅓	95	74	100	.771	.787	.639	29.003	28.984	29.010	28.999
12	73	75	67	71⅔	95	86	100	.771	.745	.662	29.013	28.999	29.023	29.012
13	68	76	66	70	95	95	100	.648	.854	.639	28.988	28.960	28.971	28.973
14	69	79	56	68	100	82	87	.708	.813	.391	29.004	29.039	29.213	29.085
15	52	68	54	58	86	60	87	.334	.411	.362	29.374	29.385	29.362	29.374
16	57	67	57	60⅓	87	84	100	.407	.556	.466	29.317	29.255	29.208	29.260
17	56	79	61	65⅓	94	66	100	.420	.651	.537	29.204	29.097	29.046	29.116
18	73	83	60	72	90	83	100	.732	.936	.518	29.003	28.965	28.981	28.983
19	65	73	52	63⅓	89	67	100	.549	.545	.388	29.040	29.056	29.067	29.054
20	64	79	52	65	77	62	100	.464	.612	.388	29.060	28.937	29.089	29.029
21	57	70	51	59⅓	87	66	100	.407	.482	.374	29.177	29.228	29.218	29.208
22	59	75	57	63⅔	82	69	100	.410	.476	.466	29.277	29.272	29.238	29.262
23	72	84	64	73⅓	72	60	100	.559	.704	.596	29.229	29.192	29.097	29.173
24	79	91	80	83⅓	82	60	83	.813	.874	.843	29.037	28.867	28.718	28.874
25	67	83	63	71	100	72	94	.662	.802	.543	28.577	28.558	28.672	28.602
26	67	79	61	69	95	69	100	.626	.691	.537	28.886	28.954	29.003	28.948
27	66	79	61	68⅔	100	95	94	.639	.945	.505	29.029	29.004	29.036	29.023
28	57	70	55	60⅔	94	95	100	.436	.695	.433	29.103	29.136	29.139	29.126
29	57	83	76	72	94	79	91	.436	.891	.812	29.147	29.026	29.062	29.078
30	79	88	73	80	91	69	95	.900	.915	.771	29.035	29.106	29.153	29.098
Sums	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Means	------	------	------	69.19	88.4	74.0	96.8	.582	.738	.551	------	------	------	29.096
Average	------	------	------	------	86.4			.624			------	------	------	------

JUNE, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
40	Cir.	100	Nim.	20	Cu.	s	4	s w	4	----	0	77	51	12 M.	3 P. M.	.16	------
----	--------	----	--------	----	--------	----	0	s w	3	----	0	79	51	---------	--------	------	------
20	Cir.	----	--------	----	--------	se	5	se	3	----	0	82	50	---------	--------	------	------
----	--------	----	--------	----	--------	s	3	s	----	s	1	86	52	---------	--------	------	------
----	--------	----	--------	40	Cir.	----	0	s w	----	s w	----	86	52	---------	--------	------	------
60	Cir. Str.	40	Cir.	----	--------	s w	----	s	4	----	0	88	60	---------	--------	------	------
20	Cir. Str.	40	Cir.	100	Nim.	s w	5	se	4	se	3	90	58	6 P. M.	In night	.11	------
100	Nim.	60	Cu.	----	--------	se	4	s w	5	----	0	79	60	---------	--------	------	------
----	--------	80	Cu.	100	Cu.	s w	1	s w	4	n w	2	82	54	---------	--------	------	------
100	Cu.	60	Cu.	100	Nim.	ne	2	s w	4	n w	5	84	61	4 P. M.	In night	.33	------
100	Cir.	100	Cu. Nim.	100	Cu.	s w	6	w	5	s w	3	65	64	Show	ers.	.15	------
40	Cu.	100	Nim.	100	Nim.	s w	6	s w	5	s w	3	78	65	11 A. M.	--------	------	------
100	Nim.	100	Nim.	----	--------	s w	6	s w	5	s w	1	78	65	2 P. M.	8 A. M.	------	------
20	Cir.	80	Cu.	----	--------	w	5	w	8	n	2	81	55	---------	7 P. M.	.33	------
----	--------	----	--------	----	--------	ne	3	n w	----	n w	----	68	45	---------	--------	------	------
100	Cu.	----	--------	----	--------	ne	----	ne	4	ne	1	73	45	---------	--------	------	------
----	--------	----	--------	----	--------	ne	2	ne	2	ne	2	78	55	---------	--------	------	------
----	--------	60	Cu.	----	--------	se	6	n w	----	n w	----	86	54	6 P. M.	6:30	.47	------
----	--------	----	--------	----	--------	n w	----	n w	5	w	2	75	51	---------	--------	------	------
----	--------	100	Cu.	----	--------	w	4	w	5	n	2	79	45	2 P. M.	6 P. M.	Trace.	------
----	--------	----	--------	----	--------	n	3	n w	4	----	0	72	43	---------	--------	------	------
----	--------	----	--------	----	--------	----	0	s w	2	s w	1	78	50	---------	--------	------	------
----	--------	----	--------	----	--------	s	7	s w	7	s w	3	85	49	---------	--------	------	------
----	--------	----	--------	----	--------	s w	9	s w	16	s w	2	92	62	In ni	ght.	2.50	------
100	Nim.	40	Cu.	20	Cir.	n w	11	w	14	w	----	83	61	---------	--------	------	------
----	--------	60	Cu.	100	Nim.	w	8	w	8	w	1	80	61	6 P. M.	--------	------	------
100	Nim.	100	Cu.	----	--------	w	2	w	3	w	2	78	61	---------	6 A. M.	.33	------
100	Cir.	----	--------	----	--------	n w	6	w	3	w	1	72	53	---------	--------	------	------
50	Cir.	----	--------	100	Cu.	w	2	s w	----	s w	----	85	48	---------	--------	------	------
40	Cir.	15	Cu.	20	Cu.	s w	----	s w	12	s w	2	89	68	In ni	ght.	.06	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	---------	--------	4.44	------
36	--------	38	--------	27	--------	----	----	----	----	----	----	80.27	54.97	---------	--------	------	------
34						----	----	----	----	----	----	------	------	---------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	78	90	71	79⅔	91	73	100	.870	1.033	.759	29.238	29.199	29.183	29.207
2	81	92	73	82	79	57	95	.829	1.005	.771	29.197	29.159	29.122	29.159
3	83	83	66	77⅓	79	79	84	.891	.891	.536	29.133	29.115	29.191	29.146
4	61	73	62	65⅓	94	63	94	.505	.510	.523	29.233	29.244	29.289	29.255
5	61	74	62	65⅔	83	67	94	.442	.568	.523	29.369	29.309	29.265	29.314
6	67	81	60	69⅓	89	59	100	.591	.624	.518	29.283	29.248	29.198	29.243
7	70	86	63	73	70	62	33	.516	.762	.478	29.195	29.133	29.077	29.135
8	80	70	68	72⅔	78	100	79	.800	.733	.543	29.057	29.046	29.078	29.060
9	68	75	55	66	79	64	87	.543	.554	.376	29.079	29.067	29.155	29.100
10	59	72	53	61⅓	88	62	100	.439	.489	.403	29.206	29.175	29.223	29.201
11	56	70	51	59	94	70	100	.420	.516	.374	29.351	29.335	29.383	29.356
12	60	78	57	65	88	65	94	.456	.626	.436	29.417	29.384	29.418	29.406
13	68	81	67	72	85	59	84	.577	.624	.556	29.392	29.355	29.335	29.361
14	69	86	67	74	85	62	95	.599	.762	.626	29.333	29.302	29.235	29.290
15	75	88	64	75⅔	81	62	94	.705	.823	.563	29.209	29.161	29.121	29.164
16	63	86	76	75	94	80	86	.543	.989	.772	29.144	29.093	29.094	29.110
17	80	90	76	82	91	63	91	.931	.887	.812	29.096	29.022	29.044	29.054
18	78	86	73	79	91	68	90	.870	.850	.732	29.049	28.992	29.008	29.016
19	76	78	67	73⅔	86	82	100	.772	.785	.662	28.995	28.986	29.032	29.004
20	68	87	65	73⅓	95	65	94	.648	.836	.583	28.987	29.058	29.186	29.077
21	67	77	63	69	95	57	88	.626	.527	.510	29.275	29.275	29.278	29.276
22	62	87	64	71	94	62	94	.523	.792	.563	29.262	29.265	29.234	99.254
23	75	89	64	76	73	62	94	.628	.855	.563	29.239	29.213	29.244	29.232
24	81	96	86	87⅔	70	89	88	.745	1.507	1.087	29.220	29.136	29.095	29.150
25	76	84	65	75	86	75	73	.772	.877	.451	29.122	29.075	29.102	29.100
26	65	86	65	72	89	83	94	.549	.904	.583	29.131	29.055	29.043	29.076
27	77	90	70	79	86	63	95	.799	.887	.695	29.016	28.935	28.935	28.962
28	79	82	73	78	82	71	95	.813	.773	.771	28.936	28.916	28.931	28.928
29	72	81	67	73⅓	95	64	89	.745	.664	.591	28.987	29.041	29.089	29.039
20	62	77	63	67⅓	94	69	94	.523	.639	.543	29.105	29.091	29.077	29.091
31	70	80	72	74	90	74	76	.658	.758	.595	29.121	29.107	29.087	29.105
Sums														
Means				73.01	86.3	69.1	89.5	.656	.776	.597				29.160
Average					81.6			.676						

JULY, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
40	Cir.	25	Cu.	----	--------	s w	3	s w	6	s w	2	91	68	--------	--------	------	------
----	--------	40	Cu.	----	--------	s w	5	w	12	s w	6	93	63	--------	--------	------	------
----	--------	40	Cu.	----	--------	s w	11	w	11	n w	2	86	63	*	--------	.05	------
----	--------	----	--------	----	--------	s w	5	w	5	----	0	76	54	--------	--------	------	------
----	--------	----	--------	----	--------	n w	4	n w	2	n w	1	77	45	--------	--------	------	------
----	--------	----	--------	----	--------	s w	1	s w	3	s w	1	82	55	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	w	5	w	1	88	52	--------	--------	------	------
10	Cu.	100	Nim.	----	--------	w	3	n w	3	----	0	85	52	11:30	12:30	.88	------
----	--------	----	--------	----	--------	w	4	----	0	----	0	76	51	--------	--------	------	------
----	--------	----	--------	----	--------	n w	1	n w	4	----	0	72	42	--------	--------	------	------
----	--------	----	--------	----	--------	n w	2	n w	3	----	0	72	40	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	w	----	e	----	82	46	--------	--------	------	------
----	--------	----	--------	----	--------	e	----	e	3	----	0	83	46	--------	--------	------	------
----	--------	----	--------	----	--------	s e	1	s e	1	----	0	83	46	--------	--------	------	------
----	--------	----	--------	----	--------	s w	2	n w	3	n w	1	91	59	--------	--------	------	------
60	Cir.	----	--------	80	Cu.	w	3	s w	1	n w	1	87	56	--------	--------	------	------
----	--------	60	Cu.	----	--------	n w	4	n w	3	n w	1	91	56	--------	--------	------	------
----	--------	80	Cir. Cu.	----	--------	s w	6	s w	10	s w	5	89	68	--------	--------	------	------
80	Cu.	80	Cu.	100	Nim.	s w	8	s w	6	----	0	86	65	In night.	--------	.07	------
40	Cir.	----	--------	----	--------	s w	1	s w	5	n w	2	86	63	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	w	3	w	1	80	48	--------	--------	------	------
40	Cir. Cu	----	--------	----	--------	n w	1	n e	5	----	0	87	49	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	n e	1	n e	----	91	54	--------	--------	------	------
----	--------	----	--------	----	--------	n e	----	s w	3	----	0	96	59	--------	--------	------	------
20	Str.	----	--------	----	--------	n e	1	n e	4	----	0	89	59	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	n e	2	n e	2	86	59	--------	--------	------	------
----	--------	60	Cu.	40	Cir.Str.	s w	5	s w	8	s w	2	91	59	--------	--------	------	------
80	Cir.	80	Cu.	80	Cir.Str.	s w	8	s w	11	s w	5	89	67	In night.	--------	Trace.	------
----	--------	----	--------	80	Cu.	s w	4	s w	3	n w	1	83	59	In night.	--------	.10	------
100	Cu.	----	--------	----	--------	s w	1	s w	2	s w	1	78	59	--------	--------	------	------
10	Cu.	----	--------	----	--------	s w	6	s w	3	s w	1	80	55	--------	--------	------	------
---	--------	----	--------	----	--------	----	----	----	----	----	----	------	-----	--------	--------	1.10	------
15	--------	18	--------	12	--------	----	----	----	----	----	----	------	-----	--------	--------	------	------
15						----	----	----	----	----	----	84.7	55.4	--------	--------	------	------

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* Shower at 10 A. M.
July 8 and 28, thunder showers.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	67	81	64	70⅔	89	66	94	.591	.704	.563	29.079	29.082	29.182	29.114
2	65	80	72	72⅓	89	70	76	.549	.717	.595	29.162	29.155	29.057	29.125
3	68	78	66	70⅔	100	82	94	.685	.785	.604	28.881	28.867	28.925	29.891
4	65	76	62	67⅔	89	91	94	.549	.812	.523	29.079	29.081	29.159	29.106
5	66	80	62	69⅓	84	74	88	.536	.758	.491	29.202	29.198	29.198	29.199
6	74	84	70	76	73	64	85	.604	.746	.621	29.209	29.175	29.086	29.157
7	72	76	68	72	86	91	100	.668	.812	.685	28.992	28.949	28.939	28.960
8	70	76	65	70⅓	95	91	89	.695	.812	.549	28.936	28.995	29.091	29.007
9	64	75	59	66	83	68	88	.497	.591	.439	29.145	29.091	29.105	29.114
10	65	80	68	71	94	66	90	.583	.677	.612	29.055	29.013	29.007	29.025
11	72	84	68	74⅔	81	68	90	.631	.789	.612	28.991	28.924	28.992	28.969
12	65	75	57	65⅔	100	56	100	.618	.484	.466	29.099	29.100	29.184	29.128
13	65	79	60	68	94	62	94	.583	.612	.487	29.263	29.245	29.279	29.262
14	65	78	63	68⅔	89	73	100	.549	.704	.576	29.293	29.266	29.249	29.269
15	63	81	67	70⅓	94	79	100	.543	.829	.662	29.035	29.077	29.082	29.065
16	68	80	74	74	100	78	90	.685	.800	.758	29.118	29.102	29.062	29.094
17	68	75	63	68⅔	100	77	94	.685	.666	.543	29.080	29.102	29.097	29.093
18	64	74	64	67⅓	94	90	94	.563	.758	.563	29.104	29.077	29.129	29.103
19	64	75	54	64⅓	89	81	100	.529	.705	.418	29.128	29.195	29.218	29.180
20	60	80	64	68	88	78	94	.456	.800	.563	29.229	29.181	29.169	29.193
21	74	86	67	75⅔	86	80	100	.718	.989	.662	29.083	29.035	29.022	29.047
22	70	85	71	75⅓	95	79	95	.695	.955	.720	29.013	28.984	28.939	28.979
23	73	95	78	82	90	68	86	.732	1.119	.827	28.967	28.876	28.945	28.929
24	68	73	65	68⅔	100	90	100	.685	.732	.618	29.007	29.007	28.965	28.993
25	63	75	63	67	100	81	100	.576	.705	.576	29.012	29.016	29.075	29.034
26	59	73	54	62	100	90	100	.500	.732	.418	29.043	29.081	29.183	29.102
27	55	74	54	61	100	67	100	.418	.568	.418	29.276	29.258	29.249	29.261
28	61	78	71	70	88	73	86	.473	.704	.644	29.169	29.111	29.041	29.107
29	71	84	61	72	95	72	94	.720	.832	.505	29.051	29.069	29.125	29.082
30	62	88	71	73⅔	88	69	95	.491	.915	.720	29.118	29.102	29.099	29.106
31	78	93	72	81	86	79	95	.827	1.094	.745	29.167	29.159	29.180	29.169
Sums														
Means				70.45	91.6	75.9	93.7	.601	.768	.587				29.125
Average					87.1			.652						

AUGUST, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
20	Cu.	20	Cu.	30	Cu.	e	2	s e	3	s	1	84	59	----	----	----	----
40	Cu.	20	Cu.	100	Nim.	s w	1	s w	----	s w	----	84	56	Night.	----	.60	----
100	Nim.	100	Nim.	100	Nim.	s w	----	w	----	w	----	81	63	A. M.	5 P. M.	.10	----
----	----	10	Cu.	----	----	w	----	n w	3	----	0	79	57	----	----	----	----
10	Cu.	30	Cu.	100	St.	s w	1	s w	3	s w	1	83	52	----	----	----	----
----	----	----	----	100	Cu.St.	s w	4	s w	7	s w	4	85	58	----	----	----	----
100	Cu. Str.	100	Cu. Str	100	Cu. Str.	s w	4	s w	7	s w	1	81	65	----	----	----	----
100	Nim.	90	Cu.	----	----	s w	1	s w	1	----	0	79	65	9 A. M.	11 A. M.	.40	----
----	----	----	----	----	----	----	0	n w	2	----	0	72	51	----	----	----	----
----	----	----	----	80	Cir.Cu	----	0	e	----	s e	----	82	51	----	----	----	----
40	Cir.	60	Cu.	----	----	s e	----	s w	4	s w	3	85	62	----	----	----	----
20	Cu.	----	----	20	Cu.	n e	5	s w	6	----	0	76	57	----	----	----	----
----	----	50	Cu.	----	----	----	0	w	3	w	1	81	47	----	----	----	----
----	----	40	Cu.	30	Cu.	s w	2	w	3	----	0	81	48	----	----	----	----
100	Nim.	60	Cir.	40	Cir.	----	0	s w	10	s w	3	82	58	6 A. M.	7 A. M.	.15	----
100	Cu.	----	----	60	Cir.	s w	4	s w	8	s w	2	84	62	In ni	ght.	.30	----
100	Nim.	60	Cu.	50	Cu.	s w	3	s w	2	s w	1	80	62	In ni	ght.	1.16	----
80	Cir.Cu	80	Cu.	----	----	s w	1	s w	2	w	2	74	62	----	----	----	----
60	Cir.	----	----	----	----	s w	2	s w	5	----	0	74	54	----	----	----	----
----	----	----	----	----	----	w	1	----	0	w	1	82	56	----	----	----	----
60	Cir.Cu	80	Cu.	----	----	s w	4	s w	6	----	0	87	59	----	----	----	----
----	----	100	Cu.	----	----	s w	1	s w	2	s w	5	86	60	----	----	----	----
80	Cu	40	Cu.	100	Cu.	s w	1	w	13	----	0	95	70	----	----	----	----
100	Nim.	100	Nim.	----	----	s w	3	s w	4	w	3	78	64	6:30 A.M	1 P. M.	.02	----
20	Cu.	----	----	----	----	n w	7	w	7	----	0	77	61	----	----	----	----
40	Cir.Str.	40	Cu.	----	----	n w	1	n e	4	----	0	72	53	----	----	----	----
----	----	----	----	----	----	n e	1	e	4	----	0	76	43	----	----	----	----
90	Cir.	----	----	----	----	s w	5	s w	9	s w	2	80	43	----	----	----	----
80	Cu.	20	Cu.	----	----	s w	3	w	4	----	0	84	60	----	----	----	----
----	----	----	----	----	----	w	1	e	4	s e	1	92	60	----	----	----	----
----	----	----	----	----	----	s w	6	s w	8	----	0	93	68	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.73	----
43	----	35	----	29	----	----	----	----	----	----	----	81.58	57.61	----	----	----	----
		.36				----	----	----	----	----	----	----	----	----	----	----	----

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	78	94	74	82	82	68	90	.785	1.080	.758	29.258	29.190	29.119	29.189
2	78	89	72	79⅔	65	73	95	.626	.997	.745	29.117	29.062	28.992	29.057
3	72	92	78	80⅔	95	64	82	.745	.956	.785	28.978	28.942	28.892	28.937
4	76	86	68	76⅔	77	54	79	.691	.677	.543	28.964	28.983	28.969	28.972
5	64	80	65	69⅔	100	78	100	.596	.800	.618	28.947	29.002	29.027	28.992
6	66	78	60	68	94	86	88	.604	.827	.456	28.911	28.957	29.017	28.962
7	57	64	47	56	94	89	92	.436	.529	.288	29.055	29.075	29.155	29.095
8	57	75	50	60⅔	81	68	93	.378	.591	.335	29.186	29.162	29.289	29.212
9	54	63	47	54⅔	87	72	100	.362	.416	.323	29.374	29.406	29.517	29.432
10	47	64	42	51	92	67	100	.298	.403	.267	29.614	29.569	29.577	29.587
11	43	64	49	52	92	62	92	.254	.373	.322	29.580	29.440	29.423	29.481
12	49	76	57	60⅔	78	64	100	.272	.577	.466	29.429	29.355	29.334	29.373
13	58	74	64	65⅓	100	86	89	.483	.718	.529	29.319	29.164	29.139	29.207
14	60	68	60	62⅔	94	85	100	.487	.577	.518	29.131	29.086	29.016	29.078
15	64	71	60	65	89	86	100	.529	.644	.518	28.978	28.961	28.951	28.963
16	62	72	54	62⅔	94	81	100	.523	.631	.418	29.008	29.046	29.108	29.054
17	51	74	64	63	93	73	100	.348	.604	.526	29.147	29.001	28.969	29.039
18	68	78	58	68	90	62	88	.612	.588	.423	28.987	28.988	29.064	29.013
19	56	67	49	57⅓	87	64	85	.391	.425	.297	29.137	29.202	29.276	29.205
20	40	66	47	51	82	68	100	.203	.438	.323	29.361	29.256	29.486	29.368
21	54	78	60	64	87	62	82	.362	.588	.426	29.363	29.258	29.209	29.277
22	66	66	65	65⅔	84	89	100	.535	.591	.618	29.085	28.897	28.741	28.908
23	62	62	52	58⅔	100	100	100	.556	.556	.388	28.737	28.865	28.984	28.862
24	55	60	51	55⅓	100	100	100	.433	.518	.374	29.084	28.997	29.134	29.072
25	55	72	51	59⅓	87	72	100	.376	.559	.374	29.169	29.120	29.087	29.125
26	59	76	51	62	88	56	100	.439	.505	.374	28.930	28.970	29.118	29.006
27	46	70	49	55	92	70	100	.286	.516	.348	29.204	29.175	29.195	29.191
28	50	74	60	61⅓	85	67	88	.309	.568	.456	29.203	29.131	29.097	29.144
29	62	84	70	72	83	75	90	.460	.577	.658	29.105	29.045	29.053	29.068
30	68	74	61	67⅔	90	86	100	.612	.718	.537	29.145	29.174	29.255	29.191
Sums														
Means				63.58	88.7	74.2	94.4	.466	.628	.470				29.135
Average					85.8			.521						

SEPTEMBER, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
20	Cu.	80	Cu.			s w	3	s w	7	s w	1	96	68				
		30	Cu.			s w	5	s w	8	s w	1	93	68				
		20	Cu.	80	Cu.	s w	5	s w	15	s w	5	95	68				
				60	Cir. Cu	s w	4	w	6	w	1	87	68	In	night.	.20	
60	Cir.	60	Cu.	60	Cir. Cu.	w	4	w	3		0	81	62	In night	6 a. m.	.69	
60	Cir.			40	Cir.	w	2	n w	9	n w	1	79	60	In	night.	.08	
40	Cu.					n w	8	w	10	w	4	65	46				
30	Cir.	40	Cu.			n w	7	n w	12		0	75	46				
20	Cir.	50	Cir.	60	Cir.	n e	2	n e	7	n e	1	65	42				
100	Cu. Str.					n e	2	n e	2		0	64	42				
						n	1	n e	5		0	69	32				
		40	Cir.				0	w	8	w	1	74	38				
		80	Cu.	100	Nim.	w	6	s w	7	s w	6	74	50				
100	Cu.	100	Nim.	100	Cu.	s w	4	w	9	s w	1	74	57				
80	Cu.	100	Cu.			s w	6	s w	4	w	1	73	55	* 10 a. m.	10:30 am	.17	
60	Cu.					w	1	w	5		0	73	54				
		80	Cir. Cu.	60	Cu. Cir.	w	1	w		w		79	44				
80	Cu.	60	Cir.			n w		w		w		78	54	In	night.	.15	
		100	Cir.			w		w	9		0	69	45				
						n	1	n		n		68	35				
						s e		s e	6	s	4	78	43				
100	Nim.	100	Nim.	100	Nim.	s e	6	s e	8	e	6	66	57	7 a. m.			
100	Nim.	100	Nim.			e	5	n e	7	e	4	67	52		In night	46	
100	Nim.	60	Cu.			e	7	s e	5	s w	2	71	51	7:30 a.m.	9 a. m.	1.25	
						w	1	n w	5	n w	1	72	43				
						w	7	n w	9		0	76	47				
						w	1	w	2		0	71	40				
						w	3	w	7	w	2	74	46				
						s w	3	s w	6	s w	4	85	55				
80	Cir. Cu.	80	Cir. Cu.			s w	3	n w	3	n w	1	76	61				
																3.00	
34		39		22								75.6	51.0				
32																	

* In night.
Sept. 4, thunder shower in night.
Sept. 15, thunder shower, 10 a. m.
Sept. 24, thunder shower, 7 a. m.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative Humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	59	73	66	66	94	85	89	.469	.693	.570	29.275	29.150	29.172	29.199
2	67	73	71	70⅓	95	85	95	.626	.693	.720	29.215	29.221	29.192	29.209
3	68	84	68	73⅓	90	75	100	.612	.877	.685	29.224	29.139	29.176	29.180
4	55	71	61	62⅓	100	80	100	.433	.608	.537	29.255	29.137	29.117	29.170
5	62	67	46	58⅓	100	100	92	.556	.662	.286	29.099	29.172	29.386	29.219
6	39	59	50	49⅓	91	82	93	.216	.410	.335	29.494	29.462	29.446	29.467
7	48	57	50	51⅔	92	100	100	.310	.466	.361	29.413	29.377	29.286	29.359
8	50	63	44	52⅓	93	100	100	.335	.576	.289	29.273	29.302	29.343	29.306
9	50	70	50	56⅔	93	90	100	.335	.658	.361	29.316	29.261	29.315	29.297
10	47	72	63	60⅔	100	66	94	.323	.524	.543	29.206	29.040	28.882	29.043
11	60	63	48	57	100	72	100	.518	.416	.335	28.877	28.867	28.997	28.914
12	48	57	48	51	92	81	92	.310	.378	.310	29.114	29.087	29.057	29.086
13	48	48	45	47	85	100	92	.285	.335	.275	28.930	28.869	28.888	28.896
14	42	41	33	38⅔	91	100	100	.244	.257	.188	28.915	28.899	29.206	29.007
15	32	53	38	41	100	80	91	.181	.321	.208	29.277	29.239	29.296	29.271
16	39	60	53	50⅔	91	82	86	.216	.426	.348	29.276	29.189	29.137	29.201
17	52	67	53	57⅓	86	55	93	.334	.362	.375	29.068	28.910	28.872	28.950
18	49	48	43	46⅔	92	78	83	.322	.260	.231	28.838	28.838	28.871	28.849
19	41	50	40	43⅔	91	93	100	.235	.335	.248	28.977	29.021	29.159	29.052
20	39	50	48	45⅔	100	100	100	.238	.361	.335	29.169	28.980	28.960	29.036
21	48	50	47	48⅓	100	93	100	.335	.335	.323	28.948	28.856	28.757	28.854
22	46	51	43	46⅔	100	86	100	.311	.321	.278	28.651	28.746	28.908	28.768
23	42	51	46	46⅓	91	79	92	.244	.296	.286	29.150	29.244	29.229	29.208
24	50	64	55	56⅓	78	73	81	.283	.433	.349	29.126	29.113	29.164	29.134
25	51	54	54	53	93	100	100	.348	.418	.418	29.093	28.931	28.867	28.964
26	33	34	32	33	100	95	95	.188	.182	.168	28.919	28.963	29.175	29.019
27	32	44	31	35⅔	79	84	89	.143	.241	.155	29.276	29.285	29.304	29.288
28	34	47	34	38⅓	79	77	89	.155	.249	.175	29.312	29.264	29.279	29.285
29	34	57	45	45⅓	89	81	92	.175	.378	.275	29.286	29.179	29.108	29.191
30	44	44	41	43	92	92	91	.265	.265	.235	29.103	28.986	29.175	29.088
31	38	44	34	38⅔	91	84	100	.208	.241	.196	29.289	29.286	29.284	29.286
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	50.43	92.5	85.4	94.5	.315	.419	.335	--------	--------	--------	29.122
Average	------	------	------	------		90.8			.356		--------	--------	--------	--------

OCTOBER, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cir.	100	Cir.	100	Nim.	n w	3	se	8	se	5	73	48	Evening.	----	.02	----
100	Nim.	100	Nim.	----	----	se	6	se	5	s w	2	73	63	----	----	----	----
80	Cu.	60	Cu.	20	Cir.	s w	2	s w	2	w	4	90	65	----	----	----	----
100	Nim.	60	Cu.	100	Cir.	n e	2	n w	2	n w	2	72	52	*	9 a.m.	.32	----
100	Cir.	30	Cu.	----	----	se	5	n w	7	n w	2	67	45	----	----	----	----
----	----	----	----	20	Cir.	n w	2	n w	4	n w	1	60	34	*	----	.13	----
100	Nim.	100	Nim.	100	Nim.	e	1	e	1	----	0	57	47	----	7 p. m.	.13	----
20	Cir.	----	----	----	----	n w	1	n w	4	n w	1	63	44	----	----	----	----
----	----	----	----	----	----	w	2	w	5	w	3	70	39	----	----	----	----
----	----	80	Cir.	100	Nim.	w	6	s	8	s	4	73	42	7 p. m.	----	----	----
100	Nim.	10	Cir.	80	Cu.	s w	3	s w	13	n w	2	65	48	----	10 a. m.	.41	----
80	Cir.	20	Cu.	20	Cir.	n w	3	n w	4	n w	7	57	42	In night	----	.03	----
100	Cir.	100	Nim.	100	Nim.	se	10	s w	6	s w	6	57	42	12 m.	In night	.12	----
100	Cir.	100	Nim.	----	----	n w	2	n w	8	n w	2	43	32	†	----	.02	----
----	----	30	Cu.	----	----	n w	2	n w	6	n w	4	52	28	----	----	----	----
60	Cir.	60	Cir.	----	----	s w	7	se	10	se	9	63	36	----	----	----	----
----	----	80	Cir.	100	Nim.	e	9	se	12	s	11	65	47	9 p. m.	----	.80	----
100	Nim.	60	Cu.	100	Nim.	s	4	s w	5	s w	7	52	41	----	8 a. m.	.11	----
100	Cu.	80	Cu.	100	Cu.	s w	8	s w	7	se	2	51	40	----	----	----	----
100	Nim.	100	Nim.	100	Nim.	se	4	se	2	----	0	56	33	‡	In night	.18	----
100	Cu.	100	Nim.	100	Nim.	----	0	n e	2	n e	4	50	46	3 p. m.	In night	.16	----
100	Cu.	60	Cu.	60	Cu.	n w	6	n w	10	n w	6	51	43	----	----	----	----
100	Cu.	60	Cu.	80	Cu.	n w	8	n w	8	n w	10	51	40	----	----	----	----
80	Cu.	60	Cir.	60	Cir.	se	11	s w	8	se	5	65	42	----	----	----	----
60	Cir.	100	Nim.	100	Nim.	se	5	s	6	s	3	64	46	1:30 p.m.	In night	.97	----
100	Nim.	100	Cu.	100	Nim.	n w	7	n	8	n w	5	34	32	§	----	----	----
100	Cir. Cu.	20	Cir.	----	----	n w	3	n w	4	n w	5	44	28	----	----	----	----
50	Cir.	60	Cir.	----	----	se	8	s	11	s	4	47	30	----	----	----	----
50	Cir.	80	Cir.	100	Nim.	s	3	se	8	se	10	57	30	7:30 p.m.	In night	.09	----
100	Nim.	100	Nim.	100	Nim.	se	7	se	3	n w	----	44	30	2 p. m.	Night.	.05	----
80	Cir.	100	Cu.	20	Cir.	n w	----	n w	5	n w	7	43	32	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3.54	----
73	----	65	----	57	----	----	----	----	----	----	----	58.4	40.9	----	----	----	----
65						----	----	----	----	----	----	----	----	----	----	----	----

* Early morn. † Afternoon. ‡ Early a. m. § Snow flurries.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of Month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	38	53	49	46⅔	91	73	85	.208	.295	.297	29.181	29.037	28.981	29.066
2	43	53	31	42⅓	83	86	100	.231	.348	.174	29.254	29.382	29.484	29.373
3	38	58	50	48⅔	91	76	85	.208	.355	.309	29.494	29.438	29.501	29.478
4	48	66	56	56⅔	85	73	94	.297	.470	.420	29.189	29.151	28.976	29.105
5	55	60	42	52⅓	94	88	91	.405	.456	.244	28.775	28.691	28.602	28.689
6	34	38	32	34⅔	89	91	100	.175	.208	.181	28.897	29.071	29.283	29.084
7	34	47	46	42⅓	89	85	92	.175	.273	.286	29.303	29.153	29.036	29.164
8	40	48	38	42	100	85	100	.248	.285	.229	29.175	29.225	29.436	29.279
9	32	35	32	33	100	100	100	.181	.204	.181	29.463	29.423	29.295	29.394
10	32	33	29	31⅓	100	100	100	.181	.188	.160	29.058	28.935	29.294	29.096
11	14	33	14	20⅓	100	80	100	.082	.150	.082	29.472	29.532	29.551	29.518
12	12	37	21	23⅓	100	81	100	.075	.178	.113	29.467	29.405	29.296	29.389
13	34	36	30	33⅓	79	90	100	.155	.191	.167	29.114	28.987	29.096	29.066
14	34	39	34	35⅔	100	91	100	.196	.216	.090	29.136	29.171	29.299	29.202
15	33	37	26	32	100	90	100	.188	.199	.141	29.346	29.321	29.328	29.332
16	22	40	26	29⅓	100	91	100	.118	.225	.141	29.310	29.278	29.191	29.260
17	23	38	40	33⅔	100	91	91	.123	.208	.225	29.219	29.108	28.905	29.077
18	39	44	38	40⅓	91	92	91	.216	.265	.208	28.788	28.775	28.785	28.783
19	39	45	38	40⅔	100	92	100	.238	.275	.229	28.808	28.960	29.160	28.976
20	34	48	41	41	89	78	91	.175	.260	.235	29.302	29.184	29.091	29.192
21	43	63	58	54⅔	83	77	70	.231	.413	.337	29.063	28.932	28.783	28.926
22	34	20	18	24	100	100	100	.196	.108	.098	28.805	28.897	29.071	28.924
23	16	22	14	17⅓	100	100	100	.090	.118	.082	29.225	29.318	29.457	29.333
24	16	22	13	17	100	100	100	.090	.118	.078	29.462	29.498	29.548	29.503
25	10	30	26	22	100	100	100	.068	.167	.141	29.517	29.403	29.253	29.391
26	26	30	24	26⅔	100	100	100	.141	.167	.129	28.939	29.253	29.362	29.185
27	20	30	21	23⅔	100	100	100	.108	.167	.113	29.506	29.432	29.409	29.449
28	20	31	29	26⅔	100	100	100	.108	.174	.160	29.237	29.037	28.841	29.038
29	31	34	32	32⅓	100	100	100	.174	.196	.181	28.793	28.718	28.751	28.754
30	29	27	28	28	100	100	88	.160	.147	.135	28.771	28.805	28.861	28.812
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	-----	------	34.40	95.5	90.3	95.9	.174	.234	.185	-------	--------	--------	29.161
Average	------	------	------	------	93.91			.191			-------	--------	--------	--------

NOVEMBER, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cir.	100	Cir. Cu.	20	Cir.	s w	8	s w	12	s w	8	53	32	----	----	----	----
----	----	----	----	----	----	w	7	s w	9	s w	4	52	31	----	----	----	----
----	----	----	----	----	----	s w	4	s	----	s	----	58	32	----	----	----	----
30	Cir.	50	Cir.	100	Cir.	s w	----	s w	12	s w	8	68	54	----	----	----	----
100	Nim.	100	Nim.	100	Nim.	s w	14	s w	----	n w	----	60	41	InNight.	----	----	----
100	Nim.	100	Cir.	100	Cir.	n w	----	n w	10	n w	2	40	31	***	InNight.	.42	----
100	Cir. Cu.	60	Cir.	----	----	n w	3	s w	16	s e	10	49	28	----	----	----	----
20	Cir.	100	Cir. Cu.	100	Nim.	s w	4	s e	2	n	6	50	34	7 p. m.	†	.57	1.
100	Nim.	100	Cir.	100	Nim.	n e	4	n e	7	n e	8	35	32	‡	----	----	----
100	Nim.	100	Nim.	----	----	n e	10	n e	7	n w	1	33	29	----	6 p. m.	.90	9.
----	----	----	----	----	----	n w	2	n w	3	n w	2	33	14	----	----	----	----
20	Cir.	80	Cir.	----	----	s w	1	s w	3	s w	3	39	10	----	----	----	----
100	Nim.	100	Nim.	100	Nim.	s e	3	s w	8	s w	5	36	21	InNight.	§	----	----
100	Nim.	60	Cir.	----	----	s w	5	n w	5	n w	7	40	29	----	‖	.37	.5
80	Cir.	60	Cir.	----	----	s w	8	s w	9	s w	1	38	26	----	----	----	----
----	----	60	Cir. Cu.	----	----	s w	3	s	3	s	1	42	19	----	----	----	----
20	Cir.	100	Cir.	100	Nim.	s e	1	s e	7	s	7	41	21	InNight.	----	.10	----
60	Cir.	80	Cir.	100	Nim.	s	4	s w	4	w	3	44	21	----	----	----	----
100	Nim.	60	Cir. Cu.	----	----	n w	5	n w	8	n w	2	46	36	----	----	----	----
30	Cir.	30	Cir.	60	Cir.	s w	1	s e	16	s e	9	48	32	----	----	----	----
50	Cir.Str.	60	Cir.	60	Cu. Cir.	s e	8	s e	16	s	16	63	39	¶	----	----	----
100	Nim.	100	Nim.	100	Cu.	s w	12	s w	16	s	13	33	18	**	----	.08	¼
100	Cu.	100	Cu.	60	Cir.	s	8	s w	7	s w	1	22	14	***	----	----	----
60	Cu.	60	Cir.	----	----	----	0	s w	1	----	0	22	10	----	----	----	----
20	Cir.	100	Nim.	100	Nim.	s	1	s w	8	s w	5	30	9	* 7 p.m.	----	----	----
100	Nim.	20	Cir.	----	----	s w	3	w	4	----	0	30	24	----	10 a. m.	.20	2
----	----	60	Cir.	80	Cu.	w	1	s w	3	s w	1	31	12	----	----	----	----
60	Cir.	60	Cir.Alt.	100	Nim.	s	3	s e	6	s e	6	31	13	* 7 p. m.	InNight	.05	½
80	Cu.	100	Cu.	100	Cu.	s e	4	s e	7	w	9	34	28	*	----	----	----
100	Nim.	100	Cu.	100	Cu.	w	9	w	9	n w	9	30	26	* ‖	8 a. m.	.03	¼
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.72	13.5
61	----	70	----	53	----	----	----	----	----	----	----	41	25.5	----	----	----	----
61						----	----	----	----	----	----	----	----	----	----	----	----

* Snow.
** Turned to snow.
*** Snow flurries.
† Turned to snow in night.
‡ Snow in night.
§ Snow and rain.
¶ Rain in night.
‖ Early A. M.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	28	34	32	31⅓	100	100	100	.153	.196	.181	28.980	29.005	29.057	29.012
2	24	37	32	31	100	100	100	.129	.221	.181	29.095	29.105	29.123	29.108
3	34	37	32	34⅓	100	90	100	.196	.199	.181	29.192	29.174	29.169	29.178
4	29	34	32	31⅔	100	100	100	.160	.196	.181	29.052	28.791	28.858	28.900
5	28	28	24	26⅔	100	100	100	.153	.153	.129	28.963	29.020	29.099	29.027
6	24	29	23	25⅓	100	100	100	.129	.160	.123	28.953	28.890	28.999	28.947
7	21	23	19	21	100	100	100	.113	.123	.103	29.023	29.040	29.192	29.085
8	18	23	18	19⅔	100	100	100	.098	.123	.098	29.397	29.474	29.650	29.507
9	21	24	20	21⅔	100	100	100	.113	.129	.108	29.716	29.663	29.450	29.610
10	21	24	20	21⅔	100	100	100	.113	.129	.108	29.232	29.105	28.927	29.088
11	27	32	28	29	100	100	100	.147	.181	.153	28.813	28.769	28 830	28.804
12	23	21	16	20	100	100	100	.123	.113	.090	28.805	28.835	29.028	28.889
13	6	18	16	13⅓	100	100	100	.057	.098	.090	29.279	29.383	29.445	29 369
14	6	17	17	13⅓	100	100	100	.057	.094	.094	29.489	29.448	29.389	29.442
15	11	25	22	19⅓	100	100	100	.071	.135	.118	29.412	29.432	29.372	29.405
16	25	37	33	31⅔	100	90	100	.135	.199	.188	29.343	29.295	29.281	29.306
17	33	36	33	34	100	100	100	.188	.212	.188	29.198	29.135	29.147	29.160
18	31	37	25	31	100	90	100	.174	.199	.135	29.229	29.311	29.319	29.286
19	25	31	33	29⅔	100	100	100	.135	.174	.188	29.173	28 986	28 777	28.979
20	32	36	35	34⅓	100	100	100	.181	.212	.204	28.780	28.859	28.867	28.835
21	34	36	34	34⅔	100	90	100	.196	.191	.196	28.883	28.927	29.035	28.948
22	34	34	32	33⅓	100	100	100	.196	.196	.181	28.909	28.705	28.797	28 804
23	32	32	29	31	100	100	100	.181	.181	.160	28.940	29.006	29.091	29.012
24	20	24	18	30⅔	100	100	100	.108	.129	.098	29.243	29.219	29.203	29.222
25	18	19	16	17⅔	100	100	100	.098	.103	.090	29.203	29.274	29.179	29.219
26	19	27	31	25⅔	100	100	100	.103	.147	.174	29.169	29.080	28.697	28.982
27	25	19	11	18⅓	100	100	100	.135	.103	.071	28.805	28.841	29 077	28.908
28	7	23	19	16⅓	100	100	100	.060	.123	.103	29.231	29.057	28.833	29.040
29	28	48	44	40	100	100	100	.153	.285	.289	28.745	28.607	28.795	28 716
30	32	22	14	22⅔	100	100	100	.181	.118	.082	28.989	29.279	29.406	29.224
31	9	14	21	14⅔	100	100	100	.065	.082	.113	29.620	29.625	29.690	29.645
Sums														
Means				25.99	100	98.7	100	.132	.158	.142				29.121
Average						99.6			.144					

DECEMBER, 1898, AT AGRICULTURAL COLLEGE, LANSING, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
60	Cu.	----	--------	100	Nim.	n w	9	s w	11	s w	6	32	25	*	--------	.02	¼
60	Cu.	100	Nim.	40	Cir.	s w	2	s w	5	s w	3	37	24	*	--------	------	------
30	Cu.	60	Cu.	80	Cir.	s w	1	s w	2	s w	5	37	28	--------	--------	------	------
80	Cu.	80	Cu.	100	Nim.	n w	5	n w	8	n	6	35	27	¶	--------	.05	½
80	Cu.	100	Cu.	15	Cu.	n w	7	n w	11	n w	5	28	24	--------	--------	------	------
100	Cu.	80	Cu.	100	Nim.	s w	5	s w	12	s w	10	30	22	†	11 a. m.	.05	½
100	Nim.	60	Cu.	80	Cu.	s w	8	n w	8	n w	9	23	19	‡	--------	.25	2½
80	Cu.	----	--------	----	--------	n w	6	n w	7	n w	6	22	16	--------	--------	------	------
20	Cu.	80	Cu.	100	Cu.	n w	6	n w	9	n w	16	24	18	--------	--------	------	------
100	Cu.	80	Cu.	----	--------	w	16	w	18	n	9	27	18	--------	--------	------	------
60	Cu.	20	Cu.	80	Cu.	w	10	s w	8	w	2	32	18	--------	--------	------	------
80	Cu.	100	Cu.	80	Cu.	se	4	se	3	se	5	24	16	--------	--------	------	------
----	--------	20	Cir.	----	--------	n w	3	n w	6	n w	9	18	6	--------	--------	------	------
20	Cir.	80	Cir.	----	--------	w	9	w	13	w	9	18	6	--------	--------	------	------
----	--------	30	Cir.	----	--------	s w	6	s w	8	s w	10	28	11	--------	--------	------	------
10	Cu.	90	Cu.	40	Cu.	s w	7	s w	12	s w	10	37	18	--------	--------	------	------
80	Cir.Cu	----	--------	80	Cu.	s w	10	s w	10	s w	6	36	29	--------	--------	------	------
100	Cu.	20	Cir.	----	--------	s w	6	s w	5	s w	6	37	25	--------	--------	------	------
100	Cu.	100	Nim.	100	Nim.	se	7	e	8	se	3	37	23	§	Innight	.55	------
100	Cu.	100	Cu.	100	Cu.	s w	11	s w	9	w	9	36	33	--------	--------	------	------
100	Cu.	100	Cu.	100	Cu.	w	13	s w	12	se	2	26	33	*	--------	------	------
100	Nim.	100	Nim.	100	Nim.	se	3	se	4	n e	10	34	32	‖	**	.75	2
80	Cu.Str.	70	Cu.Str.	70	Cu.Str.	n w	10	w	16	w	2	32	20	In night	Snow	------	------
100	Nim.	100	Nim.	100	Cu.	s w	7	s w	11	w	2	22	18	--------	--------	------	------
50	Cu.	50	Cu.	75	Cu.	w	3	w	4	w	1	31	6	--------	--------	------	------
90	Cu.	90	Cir.	100	Nim.	s w	8	s w	20	s w	17	31	3	--------	--------	------	------
100	Nim.	100	Nim.	----	--------	w	13	n w	13	w	5	29	0	--------	--------	------	------
100	Cu.Str.	100	Cu.Str.	95	Cu.Str.	s w	4	s w	8	s w	15	32	9	--------	--------	------	------
----	--------	----	--------	100	Nim.	s	16	s	16	s w	3	48	18	In night	--------	Trace.	------
100	Cu.	100	Cu.	100	Cu.Str.	n	7	n w	4	n w	4	22	2	--------	--------	------	------
10	Cir.	50	Cu.Str.	5	Cu.	se	4	se	5	n e	6	21	9	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.67	5.75
67	--------	66	--------	63	--------	----	----	----	----	----	----	30.1	18.0	--------	--------	------	------
65						----	----	----	----	----	----	------	------	--------	--------	------	------

* Snow flurries.
† Snow, 8 a. m.
‡ Snow during day.
§ Rain, 10 a. m.
‖ Rain, in night.
¶ Snow flurries, in night.
** Turned to snow in night.

BULLETINS

OF THE

AGRICULTURAL COLLEGE EXPERIMENT STATION

ISSUED DURING THE

YEAR ENDING JUNE 30, 1899

EXPERIMENT STATION BULLETINS.

FERTILIZER BULLETIN.

BY R. C. KEDZIE, CHEMIST.

Bulletin 161.—Chemical Department.

Act No. 26 of the session laws of 1885 provides for the inspection, analysis and licensing of commercial fertilizers sold or offered for sale in this State, under the direction of the State Board of Agriculture. The law has been printed in full in the Fertilizer Bulletins in years past, and it is not necessary to reprint it now. A summary of its provisions is given instead of the full text.

1. Any person selling a commercial fertilizer, the retail price of which exceeds $10, must stamp each package with the trade name, number of pounds and the percentage of nitrogen, phosphoric acid and potash.
2. Before offering such fertilizer for sale, a certificate of its analysis and a specimen of such fertilizer must be deposited with the Secretary of the Board, with a fee of $20 for each brand of fertilizer, on or before the first day of May. If the manufacturer fulfills all the conditions of this section for any given brand of fertilizer, his agent for such fertilizer is not required to take out a license; otherwise each agent must take out a license, or be liable to the penalty.
3. The penalty for violating this law is a fine of not less than $100 for the first offense and $300 for every subsequent offense.

The law is very plain, and it would seem that no one need misunderstand it. Yet a few points need to be emphasized. The sample of fertilizer, certificate of analysis and fee for license must be deposited with the Secretary on or before the first day of May each year. If the manufacturer neglects or refuses to take out a license, each dealer must take out a license to avoid the penalty. It would be wise for the retailer to refuse to handle the fertilizers of any manufacturer who does not protect his agents by promptly complying with the law. The agent would regard it as a hardship to pay $100 fine because of the neglect of his principal.

OBJECT OF THE LAW.

It is the aim of this law to protect two classes; the farmer in buying fertilizers, and the manufacturer in selling his products. By publishing the real nature of the fertilizer as shown by analysis of the material found in the open market the intelligent farmer can make some estimate of the value and know the amount of desirable materials in the fertilizer, and thus be protected from fraud. The honest manufacturer is protected by the same means from the competition of dishonest competitors, who would undersell him by means of worthless goods. The results of analysis are published only of the goods of such dealers as have complied with the law and are willing to let the public know the real quality of their fertilizers. If such goods are offered for sale in this State which do not appear in this Bulletin, the prudent farmer will do well to avoid such fertilizers.

GATHERING AND ANALYZING.

The fertilizers are gathered in the open market by a representative of the College, selecting specimens from a number of bags, if possible, to secure an average of the fertilizer; it is then analyzed in duplicate to avoid accidental errors, and the results of analysis then compared with the claims of the manufacturer. The results as *claimed* by the manufacturer and *found* by the chemist are printed in parallel lines for easy comparison.

FEATURES OF THE TABLE.

In the table are given the name and address of the manufacturer, the trade name of the fertilizer, the name and locality of the dealer from whom the specimen for analysis was obtained, and then the results of analysis, *available nitrogen, phosphoric acid, absolute potash* or oxide of potassium, and a final column of the estimated commercial value.

Such approximate estimate is made by finding the retail price at commercial centers of the different fertilizing materials, then from the amount of these several materials in a ton, multiplied by the price, from the sum of the products thus obtained we find the commercial price of the fertilizer.

In this estimate we have only considered the *first cost* of the raw material. No account is taken of transportation, the cost of mixing, sacking, commission to agents, profit on capital employed, etc., etc. For these reasons the commercial price will usually be much below the price of the fertilizers in market.

SCHEDULE OF COMMERCIAL PRICES.

The following prices per pound for fertilizing materials have been used in estimating the commercial value:

	Per pound.
Nitrogen in nitrates	14 c
Nitrogen in Ammonia Salts	13½c
Organic nitrogen in meat, blood, etc	14 c
Organic nitrogen in fine bone and tankage	13½c
Organic nitrogen in medium bone and tankage	11 c
Organic nitrogen in coarse bone and tankage	8 c
Phosphoric acid, available	5½c
Phosphoric acid, insoluble, in fine bone and tankage	4 c
Phosphoric acid insoluble, medium bone and tankage	4 c
Potash as muriate	4½c
Potash as sulphate and in wood ashes	5 c

In the table of analysis the results are given as so many parts in a hundred. Since there are 20 times 100 pounds in a ton, if we multiply the value of one pound by 20 we find the value of one per cent of any material in a ton. We may thus construct a table for estimating the value of any materials found in the results of analysis. One per cent means 20 pounds in a ton, and if the material is worth 5 cents a pound, then each per cent equals $1.00 for a ton.

COMMERCIAL VALUE AND AGRICULTURAL VALUE.

The commercial value and the agricultural value are not identical. The commercial value merely represents the cost of the material to make the fertilizer, if any one should attempt to make his own. The agricultural value or the benefit from the use of such fertilizer will depend upon a variety of conditions, such as the kind of soil, the crop, the season, the tillage, time of application, etc., etc. Let no one suppose that the estimate of the commercial value is a guarantee of a corresponding profit by its use on the farm. It may serve, however, as a basis of comparison between different brands of fertilizers. The reliable test of the value is determined by its use on a given soil and crop—worth more than all theoretical discussions and deductions. Yet there are certain general considerations which go to show the probable benefit of any fertilizing element when used on a certain kind of soil and crop, which will be of some benefit in selecting a fertilizer.

TERMS EXPLAINED.

In the table giving the results of analysis of commercial fertilizers there are certain terms used which require explanation: "Available nitrogen, estimated as ammonia;" under "Phosphoric acid" the terms "Available P_2O_5;" "Insoluble P_2O_5;" "Total P_2O_5" and "Potash soluble in water, estimated as K_2O."

Nitrogen may exist in available form either as a salt of ammonia, a nitrate, or in organic material such as dried blood, and be equally valuable in these several forms. But for ease of comparison in different manures chemists estimate it as if all these forms of nitrogen existed in the form of ammonia. Chemists estimate the compounds of phosphorus in manures as anhydrous phosphoric acid, P_2O_5; that is phosphoric acid deprived of water; when this anhydride combines with water, the acid is formed. Thus if three molecules of water are added to one of P_2O_5 two molecules of phosphoric acid are formed $3H_2O + P_2O_5 = 2H_3PO_4$ = phosphoric acid The P_2O_5 in separate form does not exist in any soil, but this expression is chosen because the amount of this combination of phosphorus is easily indicated, without considering what material the acid may be combined with. "Available P_2O_5" signifies the per cent of the acid in a form directly usable by the plant: "Insoluble P_2O_5," the per cent of acid in the condition of phosphate rock. By adding together the "Available" and "Insoluble" we get the "Total P_2O_5."

The "Potash soluble in water estimated as K_2O," is the soluble potash salt estimated only as regards the oxide of potassium = K_2O=oxide of kalium or potassium.

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Armour & Co., Chicago	Fruit and Root Crop Special	B. F. Pixley, St. Joseph
Armour & Co., Chicago	Bone, Blood and Potash	L. F. Jones, Grand Rapids
Armour & Co., Chicago	All Soluble	Corbat & Dawson, Lenox
Armour & Co., Chicago	Grain Grower	Corbat & Dawson, Lenox
Armour & Co., Chicago	Ammoniated Bone with Potash	L. F. Jones, Grand Rapids
Armour & Co., Chicago	Bone Meal	L. F. Jones, Grand Rapids
Armour & Co., Chicago	Phosphate and Potash	Corbat & Dawson, Lenox
James Boland, Jackson	Blackman	Manufacturer
Bradley Fertilizer Co., Boston, Mass.	English Lawn Fertilizer	Manufacturer
Bradley Fertilizer Co., Boston, Mass.	Ammoniated Dissolved Bone	Manufacturer
Bradley Fertilizer Co., Boston, Mass.	Dissolved Bone with Potash	J. C. Cozadd, Wayne A. G. Adams, Washington
Bradley Fertilizer Co., Boston, Mass.	B. D. Sea Fowl Guano	Milo Quirk, Imlay City
Bradley Fertilizer Co., Boston, Mass.	Niagara Phosphate	A. G. Adams, Washington
Bradley Fertilizer Co., Boston, Mass.	Potato Fertilizer	C. W. Brabb, Romeo
Bradley Fertilizer Co., Boston, Mass.	Soluble Dissolved Bone	Manufacturer
Crocker Chemical Co., Buffalo, N. Y	General Crop Phosphate	Manufacturer

for 1898, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid.			Potash soluble in water estimated as K_2O.	Station valuation.
		Available.	Insoluble.	Total.		
Claimed Found	2 to 3 2.23	8 to 10 7.64	1.5 to 2.5 6.79	9.5 to 12.5 14.43	5 to 6 6.22	----------- $25 02
Claimed Found	5 to 6 5.40	8 to 10 8.79	1.5 to 2.5 3.59	9.5 to 12.5 12.38	7 to 8 6.68	----------- 31 65
Claimed Found	4.25 to 5.5 3.77	8 to 10 9.47	1.5 to 2.5 1.70	9.5 to 12.5 11.17	4 to 5 4.91	----------- 25 06
Claimed Found	2 to 3 2.00	8 to 10 7.97	1.5 to 2.5 7.51	9.5 to 12.5 15.48	2 to 3 2.51	----------- 21 74
Claimed Found	3 to 4 4.25	6 to 8 11.02	1.5 to 2.5 1.47	7.5 to 10.5 12.49	2 to 3 3.17	----------- 25 92
Claimed Found	3 to 4 3.54	10 to 14 9.69	13.5 to 15 15.73	23.5 to 29 25.42	----------- -----------	----------- 29 65
Claimed Found	----------- -----------	10 to 12 8.34	1.5 to 2.5 6.36	11.5 to 14.5 14.70	2 to 3 2.07	----------- 17 60
Claimed Found	.94 1.19	3.86 2.29	2.06 3.40	5.92 5.69	2.51 3.89	----------- 11 29
Claimed Found	5 to 7 Anitrate 4.54	4 to 5 6.03	1 to 2 1.80	5 to 7 7.83	2.5 to 3.5 2.85	----------- 21 40
Claimed Found	2 to 2.90 2.09	5 to 6 8.06	1 to 2 2.06	6 to 8 10.12	1 to 2 1.18	----------- 16 75
Claimed Found	1 to 2 1.43	5 to 6 7.43	2 to 3 2.56	7 to 9 9.99	2.15 to 3.25 2.54	----------- 15 95
Claimed Found	2.50 to 3.5 2.23	5 to 6 8.99	2 to 3 1.77	7 to 9 10.76	1.5 to 2.5 1.49	----------- 17 76
Claimed Found	1 to 2 1.34	5 to 6 7.42	1 to 2 3.01	6 to 8 10.43	1.08 to 1.63 1.19	----------- 15 33
Claimed Found	2.50 to 3.5 2.18	6 to 7 8.33	2 to 3 3.22	8 to 10 11.55	3.25 to 4.35 2.59	----------- 19 16
Claimed Found	----------- -----------	11 to 12 14.11	.75 to 1.0 1.74	11.75 to 13 15.85	----------- -----------	----------- 17 26
Claimed Found	1 to 2 1.38	7 to 10 7.14	1 to 2 1.28	8 to 12 8.42	1.08 to 2.50 1.12	----------- 13 33

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Crocker Chemical Co., Buffalo, N. Y.	Universal Grain Grower	Manufacturer
Crocker Chemical Co., Buffalo, N. Y.	New Rival Ammoniated Superphosphate	F. C. Goodeyne, Bay City
Crocker Chemical Co., Buffalo, N. Y.	Bone Black Fertilizer	F. C. Goodeyne, Bay City
Crocker Chemical Co., Buffalo, N. Y.	Vegetable Bone Superphosphate	F. C. Goodeyne, Bay City
Crocker Chemical Co., Buffalo, N. Y.	Special Potato Manure	Seth Lathrup, Richmond
Crocker Chemical Co., Buffalo, N. Y.	Ammoniated Bone Superphosphate	Seth Lathrup, Richmond
Crocker Chemical Co., Buffalo, N. Y.	Potato, Hop and Tobacco Phosphate	Seth Lathrup, Richmond
Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker with Potash	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Buckeye Ammoniated Bone Superphosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Horse Head Phosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Phospho Bone	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	XXX Superphosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Potato and General Crop	E. W. Spencer, Petersburg
Detroit Sanitary Works, Detroit	Clover Leaf	Wm. Green, Wayne
Detroit Sanitary Works, Detroit	Superior Potato	Wm. Green, Wayne
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Standard Phosphate	Manufacturer
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Club and Grange Formula	Manufacturer

for 1898, expressed in parts in a hundred.

	Available nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.	Station valuation.
	Estimated as ammonia.	Available.	Insoluble.	Total.		
Claimed	1 to 2	7 to 10	1 to 2	8 to 12	2.70 to 4.0	
Found	1.29	7.38	1.00	8.38	2.70	$14 68
Claimed	1.5 to 2.5	10 to 12	1 to 3	11 to 15	1.60 to 3.0	
Found	1.48	9.30	1.46	10.76	1.89	16 87
Claimed	2.25 to 3.25	8 to 10	1 to 2	9 to 12	1.48 to 2.0	
Found	1.68	9.41	1.87	11.28	1.68	16 56
Claimed	6 to 7	6 to 7	1 to 2	7 to 9	5.94 to 8.0	
Found	5.81	7.52	.77	8.29	6.10	25 50
Claimed	4.5 to 5.5	8 to 10.	1 to 2	9 to 12	5.40 to 6.40	
Found	4.28	8.41	.60	9.01	5.11	22 58
Claimed	3.5 to 4.5	10 to 12	1 to 2	11 to 14	1.08 to 2.0	
Found	3.40	10.09	1.38	11.47	1.13	20 89
Claimed	2.5 to 3.5	10 to 12	1 to 2	11 to 14	3.25 to 4.30	
Found	2.51	10.21	.93	11.14	2.77	20 32
Claimed	1.5 to 2.5	10 to 12			2 to 3	
Found	1.73	8.78	3.03	11 81	2.13	18 65
Claimed	3 to 4	9 to 10			1 to 2	
Found	2.86	9.34	3.62	12.96	1.09	21 33
Claimed	1.5 to 2.5	10 to 12				
Found	1.65	9.32	3.11	12.43		17 03
Claimed		10 to 12	2 to 3	12 to 15		
Found		12.45	2.26	14.71		15 96
Claimed	.75 to 1.5	10 to 12			1 to 1.5	
Found	.87	8.99	3.40	12.39	1 45	16 68
Claimed		13 to 15				
Found		13.70	1.61	15.31		16 68
Claimed	1.25 to 2 50	10 to 12			6 to 7	
Found	1.65	9.89	3.50	13.39	5.50	23 55
Claimed	2.5 to 3.5	7 to 9	1 to 2	8 to 11	2 to 3	
Found	2.76	6.92	3.88	10.80	2.28	19 90
Claimed	4 to 5	6 to 8	1 to 2	7 to 10	4 to 5	
Found	4 34	5.38	3.08	8.46	4.68	23 32
Claimed	1.5 to 2.5	9 to 11	1 to 2	10 to 13	2 to 3	
Found	1.77	11.18	1.41	12.59	1.82	18 46
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	1.08 to 2.08	
Found	1.20	9.76	1.74	11.50	1.28	15 59

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Potato, Tobacco and Truck Manure	Manufacturer.
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Dissolved Bone and Potash	Manufacturer
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Dissolved Bone Phosphate	Manufacturer
Jarecki Chemical Co., Sandusky, O	C. O. D. Phosphate	Manufacturer
Jarecki Chemical Co., Sandusky, O.	Lake Erie Fish Guano	J. H. McMann, Richmond
Lister's Agricultural Chemical Co., Newark, N. J.	Success	Mr. Andrews, Washington
Frank N. McOmber, Jt. Joseph, Mich.	Meat and Bone	Manufacturer
Michigan Carbon Works, Detroit	Desiccated Bone	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Red Line Ammoniated Bone	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Red Line Phosphate with Potash	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Red Line Complete Manure	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Homestead Bone Black	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Acid Phosphate	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Banner Dissolved Bone	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Homestead Potato Grower	W. F. Edmunds, New Haven.
Michigan Carbon Works, Detroit	Perfection Fruit Grower	W. F. Edmunds, New Haven.
Niagara Fertilizer Co., Buffalo, N. Y.	Wheat and Corn Producer	Stafford & McKay, Romeo
Niagara Fertilizer Co., Buffalo, N. Y.	Grain and Grass Grower	Manufacturer

for 1898, expressed in parts in a hundred.

	Available nitrogen.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.	Station valuation.
	Estimated as ammonia.	Available.	Insoluble.	Total.		
Claimed	2.35 to 3.25	9 to 11	1 to 2	10 to 13	4 to 5	
Found	2.21	10.83	1.22	12.05	3.87	$20 76
Claimed		8 to 10	1 to 2	9 to 12	2 to 3	
Found		9.87	1.31	11.18	2.79	14 96
Claimed		14 to 16	1 to 2	15 to 18		
Found		15.46	.96	16.42		17 97
Claimed		14 to 15	1 to 2	15 to 17		
Found		14.39	1.23	15.62		17 06
Claimed	2 to 3	10 to 12	1 to 2	11 to 14	1 to 2	
Found	1.73	11.40	2.17	13.57	1.55	18 95
Claimed	1.5 to 2			9.5 to 11	2 to 3	
Found	1.55	8.79	2 35	11.14	2.08	17 56
Claimed	No claim					
Found	5.21	4.76	4.09	8.85	.17	15 51
Claimed	1.82 to 3.03	25 to 30				
Found	2.21	15.22	13 87	29.09		31 84
Claimed	2 to 3.04	8 to 10				
Found	2.18	10.11	1.50	11.61		17 45
Claimed		10 to 12			3 to 4	
Found		13.17	.36	13 53	3.01	17 86
Claimed	1.28 to 2.25	8 to 11			1.50 to 2.50	
Found	1.79	10.09	1.47	11.56	1.44	17 68
Claimed	2.73 to 3.52	9 to 12			1.75 to 2.50	
Found	2.53	11 24	.26	11.50	1.61	19 85
Claimed		13 to 15				
Found		13.87	1.01	14.88	.41	16 68
Claimed		30 to 34				
Found		31.14	1.12	32.26		35 37
Claimed	2.35 to 3.25	8.5 to 10	.5 to 1.50	9 to 10.50	5 to 6	
Found	2.91	9.35	.26	9.61	4.99	22 02
Claimed	.97 to 1.51	10 to 11	1 to 2	11 to 13	7 to 8.5	
Found	1.06	12.27	1.98	14.25	7 52	25 35
Claimed	1.5 to 2	8 to 10	1 to 2	9 to 12	2.16 to 3.24	
Found	1.68	7.76	3.57	11.33	2.17	18 00
Claimed	1 to 2	7 to 9	1 to 2	8 to 11	1.08 to 2.16	
Found	1.10	7.16	.99	8.15	1.53	12 8[illegible]

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Niagara Fertilizer Co., Buffalo, N. Y.	Niagara Triumph	Manufacturer
Northwestern Fertilizer Co., Chicago	Pure Ground Bone	C. C. Van Doren, Adrian
Northwestern Fertilizer Co., Chicago	Garden City Superphosphate	C. C. Van Doren, Adrian
Northwestern Fertilizer Co., Chicago	Raw Bone and Superphosphate Mixture	C. C. Van Doren, Adrian
Northwestern Fertilizer Co., Chicago	Acidulated Bone and Potash	Manufacturer
Northwestern Fertilizer Co., Chicago	Acidulated Bone	Manufacturer
Speidel, Swartz & Co., G'd Haven	Celery Hustler	J. Robins, Grand Haven
Joseph Lister, Chicago	Pure Bone Meal	C. H. Farnum, Benton Harbor.

for 1898, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid. Available.	Phosphoric acid. Insoluble.	Phosphoric acid. Total.	Potash soluble in water, estimated as K_2O.	Station valuation.
Claimed	3 to 4	8 to 10	1 to 2	9 to 12	2.16 to 3.24	....
Found	3.52	8.52	2.26	10.78	2.24	$19 80
Claimed	3 to 4	....	....	18 to 22	....	....
Found	4.51	7.65	12.57	20.22	....	24 41
Claimed	2.5 to 3	8 to 9	4 to 4.5	12 to 13.5	.54 to 1.08	....
Found	2.87	8.08	1.74	9.82	1.19	17 84
Claimed	3 to 3.5	7 to 8	....	....	.54 to 1.08	....
Found	3.52	9.17	4.89	14.06	.54	20 92
Claimed	1 to 2	10 to 12	2 to 3	12 to 15	1.5 to 2	....
Found	1 23	10.45	2.06	12.51	1.76	18 04
Claimed	1 to 2	10 to 12	2 to 3	12 to 15	....	....
Found	1 73	9 88	2.94	12.82	....	17 64
Claimed	8.62 to 9.52	3.17 to 3.40	.69 to 1 41	3.86 to 4.81	1 25	....
Found	6.72	2 67	1.24	3.91	1 28	20 39
Claimed	3.05	7 30	17.35	24.65	....	....
Found	3.57	9.16	16.03	25.19	....	29 37

THE TRIPOD OF AGRICULTURE.

It will be observed that attention is given to only three manurial elements—*Nitrogen, Phosphoric acid, and Potash.* This list does not include al lthe elements contained in plants, ten others being found in all plants grown under natural conditions. But these three are the most important in plant growth; a deficiency of any one of them in the soil limits the action of all others, and the available amount of them in the soil is soonest exhausted by cropping. So important are these that they have appropriately been called the *tripod of agriculture.* If they are present in sufficient quantity and in available form, the other plant elements, in nearly all soils of our State, are found in sufficient amount, and good crops are expected unless unfavorable physical condition of the soil or season prevents.

WHY FERTILIZATION IS REQUIRED.

The virgin soil contains a certain amount of plant food in available form which the plant uses in its growth. This may be called nature's deposit in the bank of earth. By the decompositions and chemical changes constantly going on in the soil, an additional amount of fertilizing material is brought into the active form year by year and deposited in the same bank to be checked out by crops. The removal of a crop from the soil takes away a portion of these elements of fertility. If no more is removed than the portion set free by chemical changes in the soil, then the land retains its fertility; but if more is taken off in the crop, and not restored by additional deposits (manures), then the land is losing in fertility and the bank account approaches the ledger entry, "No available assets," and nature protests the farmer's draft for remunerative crops.

A glance at the amount and kind of manurial materials removed by crops may make this subject clearer.

AMOUNT OF ASH MATERIALS REMOVED BY ONE TON OF DRY CROPS.

	Pounds
Straw and fodder:	
Wheat straw	108
Oat straw	106
Cornstalks	110
Timothy hay	142
Clover hay	134
Grains:	
Wheat	40
Oats	66
Corn	30
Tubers:	
Potatoes (dry)	82
Sugar beets (dry	88
Field beets (dry)	154
Tops and waste:	
Potato tops (dry)	102
Sugar beet tops (dry)	350
Field beet tops (dry)	364
Field turnip tops (dry)	310

Nitrogen, not being an ash element, is not included in this table; it is an organic element and escapes when the plant is burned.

The large amount of ash material removed in the coarser products of the farm—straw, stalks, hay and tops of tubers—in comparison with grain, will command attention, the one low in price but rich in ash, the other high priced and low in ash.

A more specific table, giving the amount of nitrogen, phosphoric acid and potash in farm products in their natural state, was prepared by Prof. Voorhees of New Jersey and published in Farmers' Bulletin No. 44 of the Department of Agriculture. This table is quoted entire because it sets in clear light the relative impoverishing influence of different products of the farm and gives a hint of the materials adapted to make good the loss in the soil of some crops.

The fact that potatoes in their natural state contain 75 per cent of water and milk contains 87 per cent of water, will explain the small proportion of the manurial elements found in a ton of these materials.

*Pounds of manurial constituents in a ton of various farm products.**

	Nitrogen.	Phosphoric acid.	Potash.
Meadow hay	20.42	8.2	26.4
Clover hay	40.16	11.2	36.6
Wheat bran	49.15	54.6	28.6
Linseed meal	105.12	32.2	24.8
Cotton seed meal	135.65	56.2	29.2
Wheat	37.53	15.8	10.6
Oats	36.42	12.4	8.8
Corn	33.06	11.8	7.4
Barley	39.65	15.4	9.0
Potatoes	7.01	3.2	11.4
Milk	10.20	3.4	3.0
Cheese	90.60	23.0	5.0
Live cattle	53.20	37.2	3.4

* Farmers' Bulletin No. 44, Department of Agriculture.

If all the manurial materials contained in the farm products are returned to the soil, the fertility will be maintained, or even increased; but if the crops, especially the coarser portions containing the greater part of manurial matter, are removed from the farm or allowed to go to waste, improvement of the soil will naturally follow. The intelligent farmer will seek to prevent the waste of this floating capital of the farm by changing these cheap materials (rich in ash elements) into high-priced products, which contain less of potash and phosphoric acid. Compare cheese with wheat bran in the table, and then consider the price of the same, pound for pound.

Fortunately for the farmer, the three costly manurial elements are wasted to the smallest extent in feeding to stock, because the largest part reappears in the manure, which can again contribute to plant growth. One most important condition of keeping up the farm is the conversion of coarse products of the farm into manure, thus restoring the materials temporarily removed in the crop.

SOURCES OF THE FERTILIZING ELEMENTS.

A brief notice of the sources from which these fertilizing elements are derived may be of interest.

Nitrogen.—In the form of organic nitrogen, this material is derived from animal and vegetable matter containing nitrogen, such as dried blood, meat and bones, and the complex substance "tankage"—the residues of the slaughter house, the garbage of cities, etc. The sulphate of ammonia and nitrate of soda are rich in nitrogen and contain it in a soluble form, readily taken up by the plant. A small difference in estimation of value is placed upon the nitrogen according to the material with which it is combined and the readiness with which the organic materials containing the nitrogen will decompose and become soluble in water. In the table of analyses the percentage of available nitrogen is given as if it existed in the form of ammonia.

The price of available nitrogen is placed at 14 cents a pound. It is the most costly of all the manurial elements, and the farmer should seek to raise a home supply by crops of red clover, of field peas, etc. The value of red clover as a manurial crop is well known, but "the catch" is sometimes uncertain. A crop of "field peas with oats, hogged-down" in mid-summer and plowed under, is a good preparation for a wheat crop, and the pigs by increased formation of muscle will get a good start towards bacon.

Phosphoric Acid.—Mineral phosphates are found in all fertile soils, usually in very small amount and always in the insoluble form, the phosphoric acid being combined with lime, magnesia, alumina or oxide of iron. All these phosphates are insoluble in water. The most ready and valuable source of supply is bones; but the buffalo bones of the western plains have been gathered, and the slaughter houses furnish most of the bones now. Sometimes a quantity is found on the farm, and the question arises how to make the best use of them. By composting the broken bones with twice as much moist wood ashes, the bones in a few months break down and become so brittle that they will break under a blow of the shovel, and may then be mixed with the ashes to make a valuable manure. Broken bones composted with stable manure will decompose, but more slowly.

Phosphate rock is found in large deposits in South Carolina, Florida, Tennessee and Canada, in the form of phosphate of lime. For the most part it is found in hard, stony masses, entirely insoluble in water, and very slowly decomposed by weak acids and by the roots of living plants in the soil. Sulphuric acid decomposes it, removing a part of the lime, and forming a soluble or "superphosphate." This soluble phosphoric acid, and a modified form known as "reverted," are readily taken up by the plant and contribute to its growth. The soluble and the reverted are placed together and constitute the available phosphoric acid.

Wood ashes, whether fresh or leached, contain a sensible quantity of phosphate of lime, which adds to the manurial value of this neglected material.

Potash.—The commercial supply of potash is found in the form of muriate and of sulphate of potash. These are derived from the Stassfurt mines of Germany. For many crops, the potash is equally beneficial whether in the form of muriate or sulphate, but certain crops, such as the potato and sugar beet, are injured by the presence of muriates (or chlorides), while they are benefited by potash as sulphate.

A limited domestic supply of potash is found in wood ashes in the form of carbonate, which is more beneficial than muriate or sulphate because of its alkaline quality.

The farmer should remember that his most valuable mine of potash is the clay and loam of his farm. Every fertile soil contains potash, but the clay is especially rich in potash, and by the slow chemical changes in such soil, promoted by tillage, potash is constantly set free for the use of plants.

CROPS SPECIALLY BENEFITED.

The question, what crops will be specially benefited by a given fertilizing element is often asked. A full answer is not easily found, but a few suggestions are offered.

Nitrogenous Manures.—The leguminous crops, such as the clovers, peas, beans, vetches, etc., are called nitrogen-producers, because they derive most of their nitrogen from the air, and they receive little benefit from the use of nitrogenous manures. Sugar beets produce a much larger crop when fed with manures rich in nitrogen, but the quality of the beet is greatly reduced, the overgrown beets containing an increased amount of non-saccharine matter, lowering the co-efficient of purity. Such manures and unfermented stable manure are avoided in raising sugar beets.

Combined nitrogen is often called a stimulant, because it promotes a rapid and large growth of leaf and fibre. In truck farming and raising of succulent crops for immediate sale in the market, the forcing quality of nitrogen comes in good play. This is seen in the growth of juicy fruits like the strawberry. Some gardeners, as soon as the frost is out of the ground and winter mulch is removed, apply 300 to 400 pounds per acre of dried blood or hen manure, raking it into the ground, and securing a larger crop thereby.

The purest example of a nitrogenous manure is nitrate of soda. It is entirely soluble in water, and hence liable to be washed out of the soil in a wet spell unless a growing crop appropriates it and saves from loss. In a very dry season it sometimes "burns the crop." Its best effect is seen when it is applied to a crop which has little power to obtain a supply of nitrogen, yet needs to make a rapid growth in a short time to produce a paying crop. A good illustration is winter wheat, which makes such a wonderful growth in the latter part of May and in June in leaf and stalk formation. If a light dressing (100 pounds per acre) was sown on the wheatfield the forepart of May, better heading out and more wheat might be the result.

Phosphates. —No plant can grow in the absence of phosphates, and these must be found in the soil. They are necessary for every crop, but are specially beneficial for certain crops—the clovers and other crops of this class, turnips and all root corps, and grain crops of every kind. One special influence of phosphates, viz., the early ripening of crops, makes this fertilizing element of special value to market gardeners who raise melons, squashes, grapes, etc., that are liable to injury by frost in the fall. A difference of two weeks in ripening may make the difference between profit and loss.

Potash is in universal demand in plant life. It is in demand with potatoes and other roots, the grasses and clover. Fruit trees require a large amount of potash. The ash of grapevine contains 29 per cent and of the apple tree 12 per cent of potash, and fruits are called "potash feeders."

For keeping up the vigor and health of an orchard, a manure consisting of three parts of wood ashes and one of bone meal will be useful. If wood ashes cannot be had, then a mixture of two parts of muriate of potash and three of bone meal, as recommended by Prof. Voorhees, may be substituted.

The fertilizers given in the table of analyses comprise all the fertilizers that have been licensed for sale in this State; the sale of any others is illegal, and the seller is liable to the legal penalty.

The analytical work for this Bulletin has been mainly performed by L. S. Munson, B. S., the efficient chemist of the Experiment Station.

R. C. KEDZIE,
Chemist.

Agricultural College, Mich.,
June 25, 1898.

FORESTRY BULLETIN.

INTRODUCTION.

Bulletin 162.

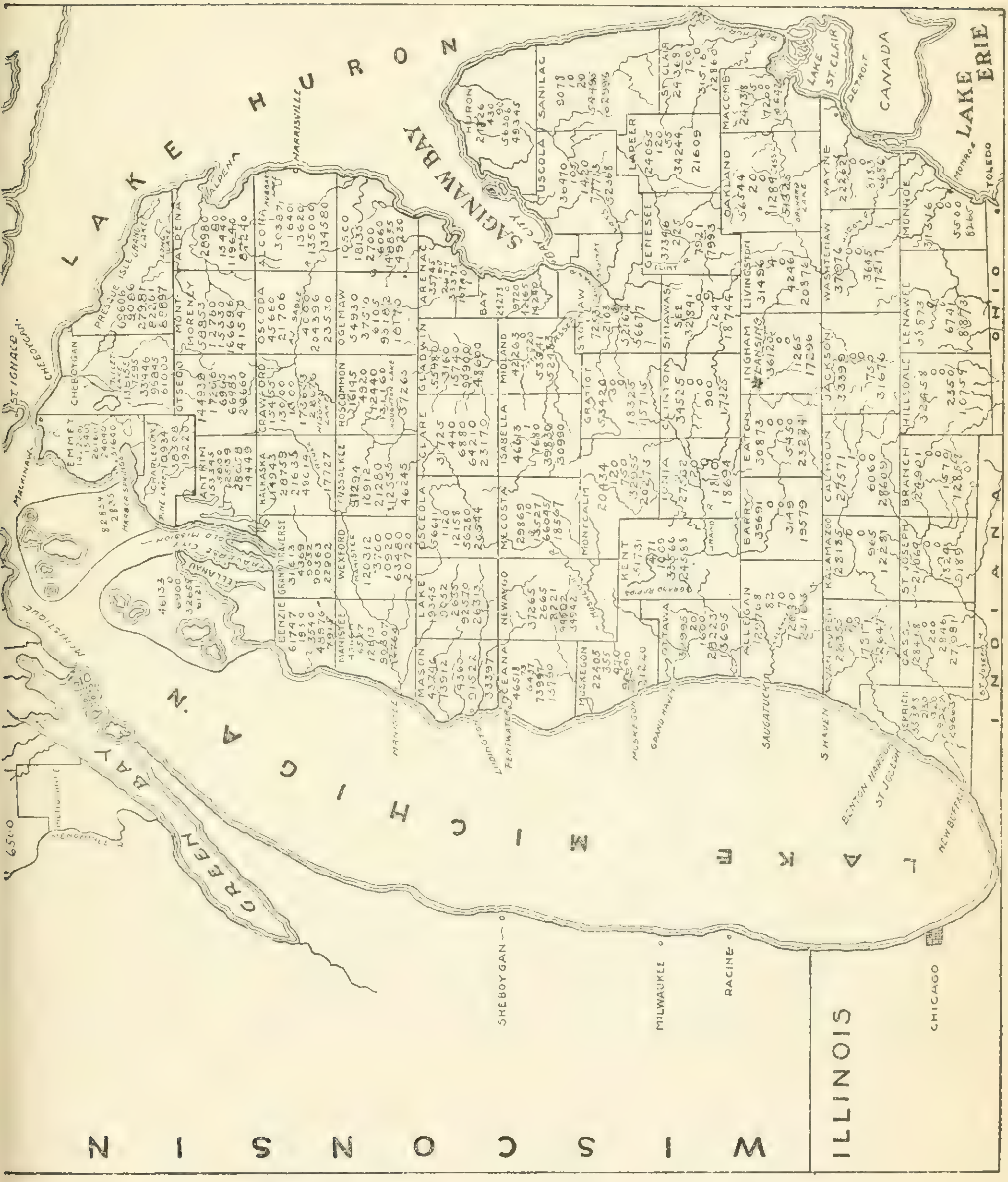
The forests of Michigan have been one of the chief sources of the wealth of her citizens. The vast tracts of white pine that once covered the central and northern portions of the lower half of the state and nearly the whole of the upper peninsula were fully ripe and ready for harvest in those decades in which the trees fell by the woodsman's ax. This harvest has been well nigh completed, until today the areas covered with woods are no more measured by square miles but by acres. The influences of the cutting of the forests are felt in the spring freshets and summer disappearance of streams that used to be even in volume and perennial in flow, and in climatic changes that are hostile to the growing of crops.

In what parts of the lower peninsula were the original forests found? Where are the standing forests of the present day and what is their extent? What is the present condition and the possible future of the denuded areas? What is the relation of the forests to meteorological conditions? Can these stump lands be reforested and how? Judging from the legislation in other states, may laws be passed and enforced that shall aid in protecting existing and proposed forest areas from fire and vandalism?

It is to answer these and incidently many other questions that this bulletin is issued. It is true, past all question, that if fire and domestic live stock can be kept out of the more fertile sections of the area once covered with pine and hardwoods, nature, left to herself, would in time cover them with a new and valuable growth of trees. Aided by the hand of the trained forester she will accomplish the end much sooner and will provide a forest much better suited to the wants of man.

Legislation aimed at the prevention of forest fires can be enforced no farther than it is supported by public opinion. Public opinion is a matter of education. It is hoped that this bulletin may be helpful in calling attention to the needs of forestry in this state on the one hand and to what is being done in other states for the preservation of forests on the other.

CLINTON D. SMITH,
Director.


LAKE HURON
SAGINAW BAY
LAKE MICHIGAN
GREEN BAY
LAKE ST. CLAIR
LAKE ERIE
CANADA
OHIO
INDIANA
ILLINOIS
WISCONSIN
EMMET
CHEBOYGAN
PRESQUE ISLE
CHARLEVOIX
OTSEGO
MONTMORENCY
ALPENA
ANTRIM
CRAWFORD
OSCODA
ALCONA
LEELANAU
GRAND TRAVERSE
KALKASKA
MISSAUKEE
ROSCOMMON
OGEMAW
IOSCO
BENZIE
MANISTEE
WEXFORD
OSCEOLA
CLARE
GLADWIN
ARENAC
BAY
MASON
LAKE
MECOSTA
ISABELLA
MIDLAND
OCEANA
NEWAYGO
MONTCALM
GRATIOT
SAGINAW
MUSKEGON
OTTAWA
KENT
IONIA
CLINTON
SHIAWASSEE
GENESEE
LAPEER
TUSCOLA
HURON
SANILAC
ST. CLAIR
MACOMB
OAKLAND
LIVINGSTON
INGHAM
EATON
BARRY
ALLEGAN
VAN BUREN
KALAMAZOO
CALHOUN
JACKSON
WASHTENAW
WAYNE
MONROE
LENAWEE
HILLSDALE
BRANCH
ST. JOSEPH
CASS
BERRIEN
MACKINAW
ST. IGNACE
CHEBOYGAN
HARRISVILLE
ALPENA
BAY CITY
PORT HURON
DETROIT
MONROE
TOLEDO
LANSING
MANISTEE
LUDINGTON
PENTWATER
MUSKEGON
GRAND HAVEN
SAUGATUCK
S. HAVEN
BENTON HARBOR
ST. JOSEPH
NEW BUFFALO
CHICAGO
RACINE
MILWAUKEE
SHEBOYGAN
MENOMINEE

A SKETCH OF THE ORIGINAL DISTRIBUTION OF WHITE PINE IN THE LOWER PENINSULA OF MICHIGAN.

C. F. WHEELER.

In the lower peninsula of Michigan, the white pine (*Pinus strobus*) was originally found scattered throughout the part of the state north of the 43rd parallel of north latitude. The actual southern limit of lumbering operations, that is, where the pines grew in numbers sufficient to be lumbered, is shown in the accompanying map, on page 123, by a dark line extending across the state, from Port Huron on the east of Covert, in Van Buren county, on the west. South of this line were a few straggling white pines in Oakland, Shiawassee, Livingston and Ingham counties, while along the Lake Michigan shore they were found southward to the Indiana line. The actual distribution of the white pine in this extensive region was due, to a large extent, to the quality and condition of the surface soil. This most valuable tree delights in sandy ridges in the neighborhood of streams. rivers and lakes and seldom grows in large, solid tracts away from these water courses. Where gravels and clays and various mixtures of these soils are found, numerous broad leaved trees struggled for supremacy forming tracts of mixed hardwood and pine forest.

In the counties of Bay, Arenac, Presque Isle, Cheboygan, Otsego, Antrim, Kalkaska and all of Leelanau were found fine forests of hardwood containing more or less white pine intermixed. In the counties of Iosco, Oscoda, Crawford, Roscommon, Missaukee, Clare, Grand Traverse, Lake, Mason and Newaygo, occurred the so-called "barrens" or "plains," where the soil is sterile and more or less covered with Jack pines (*Pinus divaricata*) and little white pine is to be found.

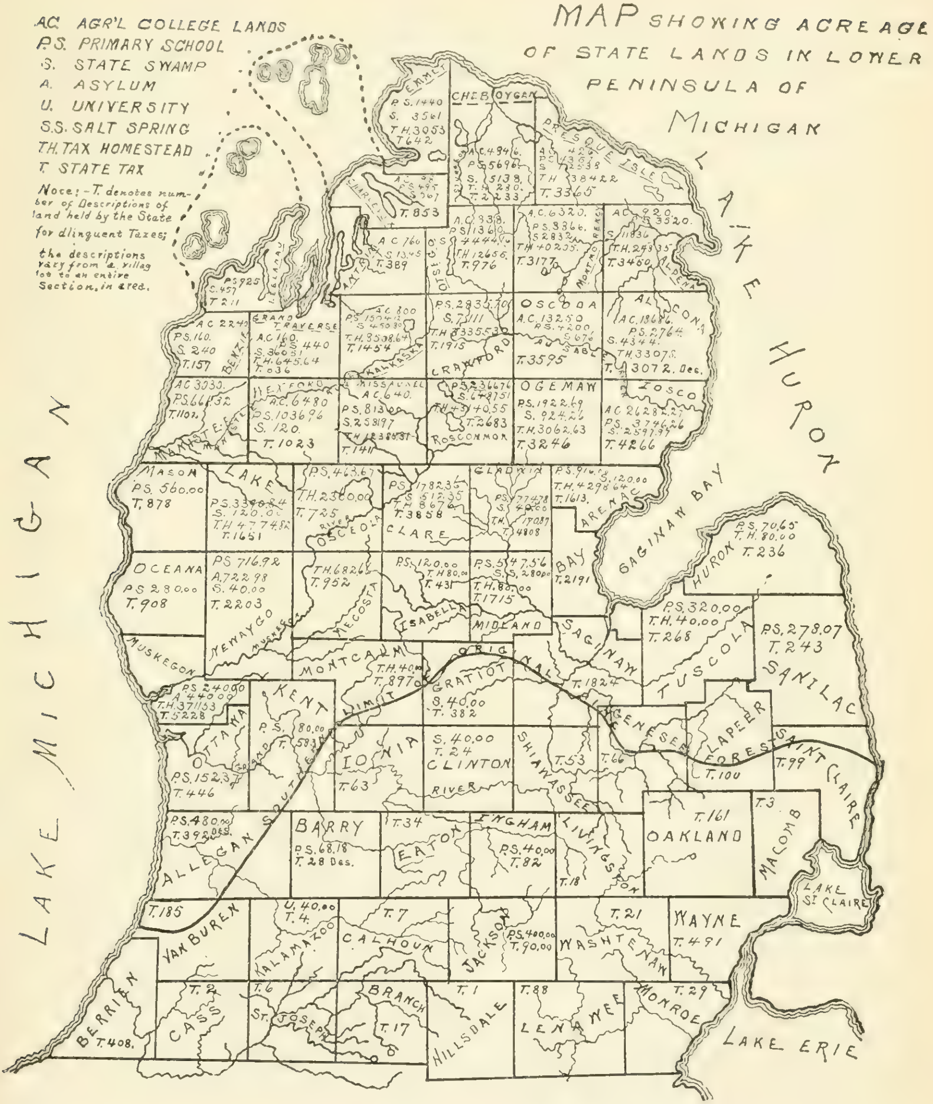
The largest and best pines were scattered among hardwood trees, towering above them—relics, probably, of the time before the hardwood existed.

The geological conditions of the great northern lobe of the lower peninsula, north of the Grand-Saginaw valleys, due to the large extent of the very friable Marshall sandstone found there, furnish the sands and gravels that the pine tree delights in. The rainfall of this region, combined with evaporation from the surrounding great lakes, was the chief remaining factor in the problem of the original distribution of white pine in Michigan.

Estimates of the total amount of white pine growing in our state have been made at various times. In 1835 the standing white pine was put down as one hundred and fifty billion feet, an estimate probably much too low. The census report for 1880 puts the amount of merchantable timber (white pine) remaining in the lower peninsula at twenty-nine billion feet. The total cut for that census year was estimated at a little over four and one-half billion feet.

The latest estimates of the amount of standing white pine remaining in Michigan were made in the year 1896-97 by Hon. Chas. H. Morse, the State Commissioner of Labor. These estimates appear in the 14th annual report of the Bureau of Labor Statistics. Schedules were sent to supervisors of townships and from the returns received the figures on the accompanying map are compiled. It was shown that there were approximately 775,208 acres of white pine still standing in the forests of Michigan at that date. The distribution of the pine, hardwood, "Jack pine plains," and swamp lands is shown on the map. The first set of figures in each county denotes the acres of hardwood in that county; the next set of figures the acres of pine; the third the acres of hemlock; the fourth the acres of "plains" land, and fifth the acres of swamp land.

C. F. WHEELER,
Consulting Botanist.


MAP SHOWING ACREAGE OF STATE LANDS IN LOWER PENINSULA OF MICHIGAN
AC. AGR'L COLLEGE LANDS
P.S. PRIMARY SCHOOL
S. STATE SWAMP
A. ASYLUM
U. UNIVERSITY
S.S. SALT SPRING
T.H. TAX HOMESTEAD
T. STATE TAX
Note:—T. denotes number of Descriptions of land held by the State for dlinquent Taxes; the descriptions vary from a villag lot to an entire Section, in area.
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE St. CLAIRE
SAGINAW BAY
EMMET P.S. 1440 S. 3561 T.H. 3053 T. 642
CHEBOYGAN A.C. 4946. P.S. 5696. S. 5138. T.H. 230. T. 2233
PRESQUE ISLE A.C. 426 P.S. 4351 S. 12538 T.H. 38422 T. 3365
CHARLEVOIX A.C. 98 P.S. 495 S. 567 T. 853
ANTRIM A.C. 760 S. 13.45 T. 389
OTSEGO A.C. 338. P.S. 1360. S. 4444.16 T.H. 12656. T. 976
MONTMORENCY A.C. 6320. P.S. 3366. S. 2832 T.H. 40205. T. 3177
ALPENA A.C. 920. P.S. 3520. S. 11836 T.H. 24835 T. 3460
LEELANAU P.S. 925 S. 457 T. 211
BENZIE A.C. 2240 P.S. 160. S. 240 T. 157
GRAND TRAVERSE A.C. 160. P.S. 440 S. 36051 T.H. 645.64 T. 636
KALKASKA A.C. 800 P.S. 15041.2 S. 4503.0 T.H. 3508.64 T. 1454
CRAWFORD P.S. 2835.70 S. 7111 T.H. 33553.0 T. 1915
OSCODA A.C. 13250 P.S. 4200. S. 676 T. 3595
ALCONA A.C. 18686. P.S. 2764. S. 4344. T.H. 33078. T. 3072. Des.
AU SABLE
MANISTEE A.C. 3030. P.S. 661.32 T. 1102.
WEXFORD A.C. 6480 P.S. 103696 S. 120. T. 1023
MISSAUKEE A.C. 640. P.S. 813.00 S. 258197 T.H. 12386.31 T. 1411
ROSCOMMON P.S. 236676 S. 648751 T.H. 43140.55 T. 2683
OGEMAW P.S. 1922.69 S. 924.26 T.H. 3062.63 T. 3246
IOSCO A.C. 26282.27 P.S. 374626 S. 2597.97 T. 4266
MASON P.S. 560.00 T. 878
LAKE P.S. 3390.84 S. 120.00 T.H. 47748.2 T. 1651
OSCEOLA P.S. 463.67 T.H. 2560.00 T. 725
CLARE P.S. 1782.35 S. 512.35 T.H. 8676. T. 3858
GLADWIN P.S. 77478 S. 40.00 T.H. 17087 T. 4808
ARENAC P.S. 916.08 S. 120.00 T.H. 429864 T. 1613.
OCEANA P.S. 280.00 T. 908
NEWAYGO P.S. 716.92 A. 722.98 S. 40.00 T. 2203
MECOSTA T.H. 6826.6 T. 952
ISABELLA P.S. 120.00 T.H. 80.00 T. 431
MIDLAND P.S. 547.56 S. 280.00 T.H. 80.00 T. 1715
BAY T. 2191
HURON P.S. 70.65 T.H. 80.00 T. 236
MUSKEGON P.S. 240.00 A. 440.00 T.H. 3711.53 T. 5228
MONTCALM T.H. 40.00 T. 897
GRATIOT S. 40.00 T. 382
SAGINAW T. 1824
TUSCOLA P.S. 320.00 T.H. 40.00 T. 268
SANILAC P.S. 278.07 T. 243
OTTAWA P.S. 152.37 T. 446
KENT P.S. 80.00 T. 583
IONIA T. 63
CLINTON S. 40.00 T. 24
SHIAWASSEE T. 53
GENESEE T. 66
LAPEER T. 100
SAINT CLAIRE T. 99
ORIGINAL FOREST LIMIT
SOUTH
GRAND
MUSKEGON
RIVER
ALLEGAN P.S. 480.00 T. 392 Des.
BARRY P.S. 68.18 T. 28 Des.
EATON T. 34
INGHAM P.S. 40.00 T. 82
LIVINGSTON T. 18
OAKLAND T. 161
MACOMB T. 3
VAN BUREN T. 185
KALAMAZOO U. 40.00 T. 4.
CALHOUN T. 7
JACKSON P.S. 400.00 T. 90.00
WASHTENAW T. 21
WAYNE T. 491
BERRIEN T. 408.
CASS T. 2
ST. JOSEPH T. 6
BRANCH T. 17
HILLSDALE T. 1
LENAWEE T. 88
MONROE T. 29

PRESENT CONDITION OF, MICHIGAN FORESTS AND STUMP LANDS WITH SUGGESTIONS AS TO THEIR CARE.

F. E. SKEELS.

The map upon this page is intended to convey some idea of the class, location and area of the lands of the lower peninsula of Michigan, which might be available for forestry purposes. These are classed as Tax Homestead, State Tax, Agricultural College and Primary School lands. The Tax Homestead lands are those which have for the most part been stripped of the original timber and forfeited back to the state for non-payment of taxes by the lumber men who had no use for the land, and in most instances would, under favorable conditions, produce another forest. These lands have been deeded by the Auditor General to the State of Michigan and are now under the control of the Commissioner of the State Land Office and can be located by bona fide residents for ten cents per acre. The State Tax lands have become the property of the state for the non-payment of taxes, and if not redeemed by the original owners, or by some speculator who sees enough timber upon certain tracts to warrant the payment of back taxes, will in time become Tax Homestead lands. The figures upon the map at the letter T denote the number of descriptions in each county, held by the state as tax lands, and although the descriptions vary in area from the village lot to entire sections of land it is safe to estimate that in the northern counties each description will mean at least 80 acres. The Agricultural College and Primary School lands are lands from which no timber has been removed and are for the most part too valuable for farming purposes to be used as forestry reserves, especially as there is so much other available territory which seemingly is not wanted for any other purpose.

A glance at the map will suffice to show that nearly all of our northern river systems have their source or sources in an area which has an abundance of Tax Homestead and State Tax lands. Thus the Muskegon river rises in Roscommon and Missaukee counties. The Manistee and Au Sable rivers, although the former discharges its waters into Lake Michigan on the west side of the state and the latter into Lake Huron on the east side, rise in Crawford and Otsego counties and the source of the one is but a mile or two from that of the other. The Sturgeon, Pigeon, Black and Thunder Bay rivers in this same locality, and in these counties and those through which these streams flow we find the greater portion of these available forestry lands.

Thus in Missaukee we have 12,385 acres of Tax Homestead, and an estimated area of 113,000 acres of State Tax land, or in round numbers 125,000 acres or over five entire townships. In Roscommon county we have an aggregate of about 250,000 acres or over ten townships in these two classes of abandoned lands.

Crawford county has 185,000 acres. Otsego has 90,000 acres, Montmorency 240,000 acres, Oscoda, Ogemaw, Alcona and Iosco each over 250,000 acres; Alpena and Presque Isle nearly 300,000 acres each. This entire territory is abundantly watered with beautiful lakes and streams abounding in trout, grayling and other fish that attest to the purity of the water, and the deer and other wild animals of the lower peninsula are almost entirely confined to this locality.

This region then, because of its area, water and excellent topography, is the place upon which to rear up a new forest, and in fact there is no other location in the lower peninsula where the state can control an area of land sufficient in extent for that purpose.

The present condition of the original forests of Michigan is the same as that of any other property that has passed into the hands of an owner, who sees in it only the dollars and cents which the article will return when put upon the market. Fully ninety per cent of all the wooded lands in our state are owned by parties who will convert the timber into merchantable forms as fast as the market will receive it. This assertion can be verified by an inspection of the offices of the numerous lumbermen who still operate in this State, and who display maps showing lots, sections and in many instances whole townships, belonging to the company controlling the same. The forest lands so held are doomed, and the length of time they will remain in their present condition is dependent entirely upon the caprice of the owner and no great amount of good can come from any discussion of these lands. Nor is this condition to be entirely deplored. Much of the timber in these forests is already past its prime; especially is this true of the larger tracts of white pine and the crop should be harvested before many years pass by. Yet if we could interest some of these large owners, men who have become millionaires by handling Michigan timber, to use some care in the cutting of these forests, we should accomplish much.

There is always a good strong undergrowth in these wooded tracts, among which are many seedlings of the better sorts of timber, and if these could be preserved the undergrowth around them would shade and protect until they would finally take care of themselves. It is not necessary to remove the old tops and pieces of tree trunks that are always left as debris after cleaning off for timber, no person who is familiar with the woods and the conditions attending the lumbering of a tract of land would ever advocate the removal of this refuse in order to burn it in some other location, and as a matter of fact, it is much better to let it lie and decay, helping to retain moisture and produce shade and protection for the remaining timber growth. But here we furnish fuel for the forest fire, and upon the proper control of this one element almost entirely depends the future of Michigan forestry. Wherever we find stump lands that have not been burned and burned over again, we there find that Nature has done and is still doing her best to restore the conditions which existed before lumbering commenced.

Our government surveyors in the original surveys of the State some sixty years ago, noted numerous windfalls. The small mounds of earth fallen from the roots of the trees which went down before the great tornadoes still mark the route taken, but the valuable growth of timber which has since sprung up is a more substantial tracing.

Sections three, four and nine of Town 23 N., R. 13 W., in Manistee county are good examples. The United States Survey in the early forties noted an extensive windfall "grown up to brush." We find the early settlers avoiding this tract, because of the light timber growth, which today is covered with a fine forest of young basswood, white ash and maple and was recently sold at a good price to a Michigan manufacturing concern. Had this tract been burned over repeatedly just as the seedlings were in their young growth, we should now find the area covered with an inferior growth of worthless stuff, if needed there were humus enough to support any vegetation at all.

The 10 per cent of the timbered lands still remaining in the hands of the commonwealth is subject to the same management as is the 90 per cent in the hands of large owners. Most of these public lands are well timbered and would have been purchased long ago except for the fact that they are for the most part isolated and too far away from transportation facilities to become of use to manufacturers. They are fast passing from the control of the state, however, and it will not be many years before Michigan as a state will have very little timber to dispose of. Much of the timber belonging to the public is ripe and should be harvested.

If there were some manner in which the public could authorize selected agents to pick out and sell off this timber which is ready to cut, and thereby retain the title in the state, we might consider the plan, but past legislatures have not taken kindly to this idea and always look with suspicion upon any plan which has for its object the disposition of the timber upon public lands, even though the trees are blown or burned down, and fast spoiling in decay. This is to be regretted, as a considerable income might have been derived from a saving made along this line—enough to have paid competent wardens for looking after these tracts of woodland. Until some such system of legislation can be had, the maintenance of the present forest areas must be at a loss of much of the valuable timber now standing, as the only method by which the value can be saved is by selling to parties who will cut it.

The maintenance of our present forests has two foes to combat, viz.:—timber thieves and forest fires, and destructive as the latter may be and have been, they must bow in insignificance to the pirates who have preyed upon the forests of Michigan ever since there was sale for any of the products. It may seem a broad assertion, but it is a fact, that more than double the amount of timber is stolen from state lands annually than is destroyed by fire. The reason for this lies in the policy pursued in the settlement of trespass committed by these vandals. The state has a good law which should be enforced against this class of people, yet we find that in the hundreds of cases of trespass upon public lands none of the trespassers have ever been prosecuted. Why is this? If one of these people were to go upon the grounds of any of the state institutions and cut down and take away a tree, or commit any other felony, he would be at once puninshed as any thief should be. Yet the same person can trespass upon the forest lands of the state and run no fear of prosecution whatever. If caught, he will be called upon to pay the stumpage value, which really means that he is buying timber and paying no taxes. One reason why prosecutions have not been had, is the fact that the Attorneys General who have held office from time to time, hold that only the prosecuting attorneys of the county wherein the offense is committed can commence suit against trespassers upon public lands (yet we find the same Attorneys General flying to the aid of the Game Warden whenever he has occasion to request their services. We assume that it would be quite as reasonable to protect the forests, which will surely become extinct under the present system, as without the forests we can have no game.) This protection can never be effectual through township or county officials, as they are too often implicated in the trespassing, or not competent to conduct the prosecutions if made. Few people in the southern portions of our state fully understand the conditions of this problem. First, it is almost impossible to impanel a jury in the northern counties, the majority of whose members have not themselves some day trespassed upon public lands. Second, in sparsely settled counties, the legal talent available for prosecuting attorney is limited to one or two persons, who are wholly unable to successfully cope with the attorneys which the trespasser will always employ, and the state is the loser thereby. Third, the trespassers and generally the representatives from these northrn districts raise the plea that these timber thieves are poor men of family, who are starving and are forced to enter upon these lands and steal to support their families. We challenge this statement, for in an investigation which has extended over the last four years, we have noted that in nearly every instance the trespasser was a man who had a good bank account, and was not forced to steal for a living, but finding it a lucrative business with no risks or taxes, kept at it. He is still at it and still will be until more stringent measures are taken to stop this business, or until the grand old State of Michigan has not a tree for him to steal. Our suggestion, then, as to the maintenance of our present forest areas are entirely along the lines of legislation. We can do nothing with public property without laws governing the same—laws which are so plain and concise that there can be no quibbling or doubt as to their meaning.

These laws should cover, first the matter of trespassers upon state lands, and by trespassers we mean malicious trespassers. There are always some few who by mistaken lines or corners get over the true line, but these are usually willing to settle and are already well provided for, but we want in addition to the good law we now have for malicious trespassers, a clause compelling the Attorney General of the State to prosecute in arrests made by the authority of the Commissioner of the State Land Office, or a clause authorizing the Land Commissioner to procure competent attorneys to so prosecute without the sanction of the Attorney General.

Second, legislation to prevent the destruction of our present forests by fire. It seems to us that the only solution of this matter is by the selection and appointment of efficient wardens by the State for the purpose. No system which depends upon the township or county officers for its execution will ever be successful. These wardens must have the sovereign power of the State back of them and in their pockets, and must be entirely removed from political influences. Game Wardens, Fire Wardens and Trespass Agents should all be State agents with full power to make arrests and to prosecute in justice courts as the Game Wardens now do. There is no Game Warden but that knows of trespass upon public lands, and there is no Trespass Agent but that often sees flagrant violations of the game laws, and these men should all be vested with as strong authority to do anything to prevent the destruction of our forests and game as can be given them by any law that can be devised. The duties of the wardens should be to prevent the use of fires wherever there is danger of damage resulting to the surrounding territory, whether owned in private or by the State. We all know the difficulties which attend the fighting of fires in our cities where we have all modern appliances for their subjection, but none of these fires can compare with the genuine forest fire where great blazing brands go whirling, whizzing, hissing, ten, twenty, and in high winds, even forty rods through the air, spreading fire so swiftly that no human power can stop it. The only place to stamp it out is before the match is lighted. Proper legislation along these lines will, we believe, do more to maintain our forest areas than any other method. If our land owners in both the southern and northern portions of Michigan would plant the sides of gulleys, hills, and rough, stony and unusually valueless ground for agricultural purposes, to forest seedlings, we would soon have an abundance of growing timber, and to bring this about the State should furnish seedlings or seeds of the ash, basswood, butternut, elms, maples, oaks, pines, walnuts and other valuable timbers to those who will use them, and also set aside similar places in its own holdings which are yet covered with forest or which have been denuded of forest by lumbermen or fires, and plant forests and properly care for them.

This brings us to the consideration of the stump lands, and by the stump lands we mean those lands which, within the memory of man, have been covered with timber, but which now are divested of everything of value and are patiently waiting for something to make them again valuable. We do not in any sense include the Jack pine plains. There are, however, oases in every desert, and we find them on the plains wherever the clay subsoil comes near enough the surface to retain the moisture, and we usually find here standing the Norway pine, or traces of its having been here; but there are hundreds of thousands of acres of good, fertile stump lands that will have ample time to grow another forest before they are wanted for agricultural purposes, and let us put our efforts here where we can show results. It is possible that the time may come when these plains may be utilized for other than grazing purposes, but it will be when our population has increased to such an extent that proper fertilization and irrigation can be brought with the people and not until then.

The legislation suggested for the maintenance of the present forest areas is also applicable to the stump lands in every feature, but there is need of more study and more clearly defined legislation along this line than the former. Most of these stump lands are or were at one time owned by some one of the wealthy lumber firms which have helped to build our State. In so far as possible, these men and firms should be induced to deed back to the State the lands for which they have no further use, and upon which most of them have ceased to pay taxes, thus again placing the lands under State control. Our present tax law introduces one of the most vexatious problems that we have to solve. If the State cannot give a good title to all tax lands, then there is no use of forestry legislation regarding these vast areas, for if she cannot give title, she has none herself, and we would not advocate the use of public money on the lands of men who only sit back and wait for them to become valuable before again claiming title and taking possession. The State cannot afford to carry on forestry experiments upon lands which she thinks she owns. The State of Michigan should never plant a tree upon lands over which the public has not absolute control and to which she has not a clear title, and under the present tax law and the supreme court decisions regarding the same it would be folly to try to re-forest the larger portion of the stump lands of this State. But once get the lands under the ownership of the Commonwealth and we can, by keeping out fires, reproduce a forest at little expense, of as much or more value than the original, and this by letting Nature do her own sweet will, aiding by a little judicious planting and pruning.

To summarize:—We must then have legislation whereby we can have wardens to protect forests, stump lands and game from fires and thieves. These wardens should have authority to arrest and commence suit, thereby lessening cost of long journeys of officers in making arrest and expensive and tedious waiting for prosecuting attorneys. It should be the duty of the Attorney General to prosecute all cases when called upon to do so. There should be such a modification of the tax laws as will do away with evasion of tax payment, through error or incompetency of township or county officials; there should be such provision made that finally all lands taken back by the State should be held in the same manner as those to which original titles can now be given.

Influence owners of stump lands to deed back to the State instead of letting lands go back for nonpayment of taxes. When the State has thus acquired absolute title to large tracts of stump lands, put them under the charge of competent wardens, help along by planting, pruning and keeping out stock, and we will soon have another forest.

METHODS OF REFORESTING PINE STUMP LANDS.

W. J. BEAL.

"The vandalism which hews down vast stretches of woodland for gain, without thought or care for the future, has too long gone on unchecked. The injury done by it has often been described and can hardly be exaggerated."—(The Providence Journal.)

Fortunately for the people of Michigan, the conditions are still such that, if the annual or perennial fires, browsing animals and timber thieves are kept out, the land surface will very soon be clothed with a woody growth. This would come about through the agency of sprouts from living stumps, roots, or grubs of a considerable number of kinds of trees and shrubs that were not completely killed by a burning of the materials on the surface of the soil. Among these may be enumerated nearly all of the broad-leaved trees and shrubs. Again, it is not common to find an area of much size that does not have left standing some one or more old trees with tops still living that were unworthy the attention of lumbermen because of defects. These trees bear seeds every other year, or less frequently, which the kind breezes, the birds or squirrels give free transportation for long distances. Considering the assistance that Nature, unmolested, is ready to bring, my task of telling how to reforest stump lands of Michigan is not as formidable an undertaking as might first appear.

A GROUP OF FINE WHITE PINES

But Nature does her work slowly and often imperfectly. Quicker returns can be made by assisting Nature. Besides keeping out the fire and grazing animals, man can assist Nature by planting four small, desirable trees to nearly every square rod, thus restocking the ground evenly.

In undertaking the proper management of stump lands numerous problems confront us:

1. What kinds of trees shall we plant; shall they be native or foreigners?
2. How many shall we plant to the acre?
3. What preparations shall we give the land?
4. How shall we care for the trees, from seedlings to maturity?
5. How shall we plant to best advantage, and at what season of the year?
6. How large shall the trees be when planted, or shall we rely on sowing and planting seeds?

7. Shall we plant one kind of tree on an acre, or shall we plant several kinds?

Prof. C. S. Sargent, Director of the Arnold Arboretum in Massachusetts, long ago began planting many kinds of forest trees, including those from Europe and other countries, and, as late as 1878, recommended for our use the planting of the Scotch pine, European larch, European linden, and several others, but in 1886, and since that time, he has turned completely about. He says "many of the conclusions reached in those papers, however, have not been substantiated by further investigations upon the same subject made during the past ten years. * * * I am now as fully convinced that the native trees of Massachusetts are better suited to Massachusetts than any exotic trees can be, and that if our woods and plantations are ever to assume real importance, and to make profitable returns upon the money invested in them, they must be composed either wholly or in large part of our native trees."

The white willow of Europe seems to be an exception to the rule just mentioned, as it grows rapidly and reaches large size in this country, and is worth planting if anyone can make use of the lumber.

Most of the trees of Europe which attain much size were long ago planted more or less at the Agricultural College, some of them as early as 1860, and many others previous to 1875. The tests there made lead me to the same conclusion for Michigan that Prof. Sargent reached for Massachusetts. Furthermore, the trials that have been made in Eastern North America lead us to conclude that there is nothing on the Rocky Mountains or on the Pacific Slope that is worth planting for growing timber in Michigan.

Prof. Sargent says further, "the most instructive plantations of Massachusetts are not those which have been made upon the European fashion, or rather with European trees, by men who have studied the subject in Europe or in European books upon forestry. The real progress in sylviculture in Massachusetts has been made by the farmers of Barnstable and Plymouth counties, who have taught us how to plant and raise forests successfully and profitably under the most favorable conditions. The secret of their success must be sought where they sought and found it, not in forest treatises, unsuited to the requirements of this community, but in the native woods in full view of their own doorstep, which told them what to plant and supplied them with material for planting.

It has been demonstrated in Barnstable county that a crop of pitch pine can be raised from seed with as much certainty as a crop of corn and with much less expense."

Half a century ago some experiments were begun in Eastern Massachusetts in planting white pines on barren sandy soil. The young trees were set in shallow furrows at odd times, with little expense, at a distance of from five to twelve feet each way, and after planting received no subsequent care whatever. They grew rapidly and vigorously. Prof. Sargent says: "Here, no doubt, are the most profitable and successful attempts at sylviculture ever made in the United States."

These experiments do not, unfortunately, show "the method of culture which can best be adopted in order to make this tree yield the greatest return. More experiments are needed with the white pine."

Where experiments were made in Massachusetts the land consisted of old fields, clear of stumps and other obstructions, while in Michigan the pine stumps are still left and the intervening spaces are often filled with logs, briars, shrubs and grasses in variety.

In making selections for planting, the nature of the soil and other conditions must be taken into account. On light sands we may not wish to rely on the conifers because of great risk from fire, but on such lands our broad-leaved trees are found to grow but indifferently, making timber of little value. For growing good timber on such lands, judging from our present knowledge, we are reluctantly forced to select some of the cone bearing trees. Still good pine has been grown on land in Michigan that also grew good hardwood. Where white pine or other kinds of first-class trees have been growing to some extent on our wild land and have not produced good timber, it is a sure sign that it is unsafe to plant such trees for profit; on the other hand, if fire and browsing animals are kept out, it is pretty safe to rely on a good crop of timber on land where one fine crop of trees has been removed.

For Michigan the following kinds have been known to grow well, each in soil suited to it; white pine, Norway pine, American elm, white ash, basswood, sugar maple, black cherry, yellow birch, red oak, and perhaps also with good care, butternut and walnut. Many others have made valuable timber, but most of them grow too slowly for profit, or grow rapidly but make timber of poor quality.

In 1863, Prof. James Satterlee, with his father, planted near Greenville, Montcalm county, a considerable grove of chestnuts, butternuts and black walnuts. All have done well and are now healthy. The leading native trees on such land were white oak and black oak. Such an experiment begun thirty-five years ago, is worth considerable to one interested in tree planting.

In some places it may be profitable to grow aspens and some other poplars, with a view of using the timber for paper pulp.

There is no danger of planting the trees too thickly, but this work costs something. The better kinds selected to plant may be scattered about among the stumps, placing four to the square rod, 640 to the acre, and among these, and near them, should be other cheap and quick growing trees or shrubs to shade the ground and help keep out grasses, herbaceous plants and weeds. For cheap nurse trees, to start quickly and shade the ground, there appears nothing better than box elder. On the light sand, Jack pine started from the seed is first rate.

AFTER A FOREST FIRE

What preparations shall be given the land?

To cover every case the answers would be numerous and long, because of varied conditions. If much rubbish is left unburned it may be best to fire it and clear the land. If grass and pasturing have left the surface with a good deal of sod, plowing will be beneficial, but this is not always possible. In case it is not, dig over a space two feet or more in diameter wherever a small tree is planted. In most places the ground is already somewhat shaded by trunks of small trees. In this case no preparation is needed, possibly, excepting the reduction of neighboring bushes the better to expose to light the young tree you are planting. Bear in mind that this planting anew has to be done but once for all time, and the work should therefore be well done.

After setting the young trees what care will they need?

Rigidly keep out fire and grazing animals. While your choice saplings are yet small, pass over the ground from year to year and lop off the tops of the surrounding bushes, if they reach much above those you are caring for. If two branches to the main trunk are very nearly equal in size, cut one off or remove a part of it, thus sending more vigor into the remaining branch, that a straight trunk may be produced. After the trees have grown so large that a crop is to be harvested there are two ways to proceed. One is to cut off every tree of any value and allow sprouts or seedlings to renew the forest, the other is to keep taking out from time to time a tree here and there as it is needed, leaving the rest to grow. On hilly land the latter method is always preferable.

Evergreens are best planted just as the buds are pushing in the spring; other trees may be planted in the spring or fall, while they are destitute of leaves.

For setting out seedlings that are six inches to a foot high in unplowed ground if the obstructions are not too numerous, two men with long-handled dibbles and a boy to handle the plants kept moist, can plant from four to five thousand per day, enough for seven acres of land. The boy should carry with him a mixture of trees of several kinds. The man thrusts a dibble into the ground, a seedling goes into the hole, the dibble is thrust again into the ground and pried toward the young tree, closing in the earth about it. If the earth is packed a little about the tree all the better.

Chestnuts, acorns and the like, should be planted one in a place, about two inches deep, where the trees are needed. This should be done usually in the spring, for then there is less risk of destruction by squirrels. The nuts may be kept over winter without loss of vitality, by burying on high land in twice their bulk of sand.

An experienced gardener knows that the roots of a young tree when exposed to dry air will live just about as long as a trout or a black bass in the same situation; the inexperienced or thoughtless person might lose most of his labor in tree planting by not knowing this fact.

The trees to be set should usually be four to twelve inches high. At this size they cost less, can be more easily planted and are more likely to make good trees.

As a guide to the selection of trees for each kind of soil or location, plant those species that formerly grew in such places. Chestnuts, if planted, should be placed in soil that is sandy or gravelly, high enough and well drained.

I suggested that the boy helping in the work should carry a mixed bunch of the trees, that the different kinds be grown together. But why mix them, you ask? Trees so planted are less liable to the attacks of insects or fungi; less liable to loss from fire or wind; they economize the room above the soil and below the surface to better advantage. Their likes and dislikes are not just the same. Pines, beeches, oaks, maples, box elders and some others will hold their lower branches covered with living leaves very well in the shade, while ashes, walnuts and chestnuts are impatient of shade and cannot be grown closely enough together to keep out grass and weeds. It would be a mistake to attempt to grow white ashes or chestnuts by the acre, each sort by itself.

I shall not here attempt to produce a complete treatise on growing and managing seeds and seedlings, but a few words seem necessary.

In case you fail to secure seeds or to grow seedlings when you need them, they can be purchased at very low prices of some nurseryman. The man who has little horticultural tact will find it cheaper to buy; the man who has the tact needs little instruction from me. To grow seedling evergreens and other delicate things, secure a spot not likely to become very dry nor to become flooded with water. The soil should be good, with a surface of rich sandy loam or leaf mold. Above this should be shade. This spot should be but little exposed to wind. With a little care such places may be selected in almost any forest, though, the spreading roots are in the way and draw out the moisture. To produce the shade it will cost but little to set or drive posts five or six feet high, and from the tops of one to the other put on horizontal strips or poles, on which throw some fine brush destitute of leaves. Here you can grow seedlings with success. Sow the seeds in rows six to eight inches apart, covering them but slightly with one-fourth of an inch of light soil. Never let the ground get dry, nor become soaked with water for a very long time, nor exposed to the sun, nor become choked with weeds. Seeds of elms, birches and maples should be planted as soon as gathered or not long after. If seeds of ashes become dry before planting in the open (as they may be with safety), they should be soaked a day or two in water till they become swollen.

RELATION OF METEOROLOGY TO FORESTRY IN MICHIGAN.

BY R. C. KEDZIE.

The controlling influence of climate over forest growth is well recognized. The distribution of plants over the earth's surface is to a large extent determined by climate, but moisture as an element of climate is controlling. The climatic conditions, as related to forest growth, and especially in connection with the question of reforesting our denuded northern plains, become matters worthy of consideration.

FOREST GROWTH.

The conditions favorable to growth of trees are good soil, proper temperature and moisture. Failure of any one of these will limit or prevent arboreal growth. A good illustration of the limitation by a poor soil is furnished in the government forests of Germany. Prof. F. S. Kedzie in a recent letter writes: "I have been all over the Royal Forest. It lies outside of the city about ten miles and is carefully watered and taken care of by a small army of foresters. The trees are all pines, planted a great many years ago, and through the forest run wild boar, deer and other game. I saw one lone red squirrel during my tour, which lasted over four hours. Only the Kaiser and his guests ever shoot or hunt the game here. * * * At one point I found a plot of pines which was planted in 1889, but the result must try even the patience of a German—the average height was not more than four feet.

I was disappointed in the appearance of the trees in the forest—they don't compare with ours at home, and I expected they would be much larger on account of the more abundant rainfall. When I told the German friend who was with me that they were beginning to agitate the forest question in Michigan he seemed greatly astonished that a man was permitted to cut down trees without planting as many acres as he cleared. There is one thing clear to my mind; we don't need to try any experiments in forestry with pine trees—the millennium is too near."

The limiting condition for forest growth are not found in our soil, which is in striking contrast with the thin sands of Prussia; but in certain sections the climatic condition, especially the rainfall, is the problem to be solved. While the climate of Michigan on the average is satisfactory, yet it still must be characterized as capricious—subject to wide variations from year to year. The influence of these climatic variations is shown in corresponding variations in tree growth. Spruce trees have grown for many years on the college lawn. When cut down, and a cross section of the trunk is examined, the concentric layers of annual growth clearly point out the good years of abundant rainfall, while the thin rings show the years of unfavorable climatic conditions. The meteorological tables for the last 34 years at this college, when compared with "the tables in wood" of annual growth, show very clearly the relations of climate to forest growth.

FORESTS AND MOISTURE.

Much has been written about the relation of forests to rainfall; some claiming that rain is increased by forests, and others that there is no connection between them.

Geo. P. Marsh, in his admirable work, "Man and Nature," has pointed out how forests restrain the rapid escape of the rain; preserving springs and small streams, retarding floods, and mitigating drought. Their influence in preventing the drifting of snow and keeping an even covering of that wonderful blanket for the sleeping earth, is well recognized.

The influence of forests in diminishing evaporation by restraining the velocity of the wind at the surface of the ground is worthy of consideration. I do not refer to the well-known influence of tall forests in restraining the violence of the wind as a body, but to the influence of forests, shrubs and vegetable growth of every kind in keeping the air quiet at the ground level, where alone soil evaporation takes place.

To obtain some measure of the relative rapidity of evaporation in a draft and in comparatively still air, the following experiment was tried: The air in one part of the chemical lecture room was so nearly still that a feather would not move perceptibly; by opening windows in an other part of the room a strong draft could be secured at one window, the wind blowing 12 miles an hour. Two square pieces of Turkish toweling of same size were thoroughly wet, just short of dripping, then weighed separately, one suspended in the still air of the room for an hour, while the other was similarly hung in the draft by the window, or in the mouth of the ventilating shaft. Both were left for an hour, then weighed again, and the loss in weight showed the amount of water evaporated in each case. The trial was made seven times, with the result that the evaporation was four times greater in the draft than in the still air. The actual amount evaporated was not the same for each hour, but the ratio of evaporation was almost identical in the whole series, viz: four times as much in the draft as took place in the still air.

The reason for this is not hard to find. A volume of perfectly still air surrounding a wet body will take up moisture with progressive slowness till the air is saturated; but if this damp air is blown away and replaced by relatively dry air, evaporation will go on with increased rapidity, and if the air is constantly renewed as in a draft of wind, the evaporation will be more rapid. Every washer-woman knows that the clothes will soon blow dry when hung out in a stiff breeze, but will take hours if lined up indoors.

The principle of my laboratory experiment will hold in the broad open of Nature. The air in contact with the moist ground will take up water till it is saturated and then evaporation will be suspended, provided the air remains still and undisturbed. But if this bottom air is swept away by wind, evaporation will be renewed and the drying of the soil will again go on. The influence of trees, shrubs and even the grasses in preserving in some degree this shallow pool of quiet air at the ground level and thus diminishing evaporation from the soil may seem a trifling matter at first thought, but become of great moment on the large scale of nature.

RELATION OF SOIL TO MOISTURE.

The capacity of a soil to imbibe and retain water is intimately connected with its composition. The open and porous soils of a sandy character take up water most readily, retain it in least quantity and part with it most rapidly by evaporation. One hundred parts of pure sand will take up 25 parts of water, and will lose 22 parts by evaporation in four hours when spread out in a thin sheet in dry air. Such soil is well called leachy and very subject to drought.

If to such sand, clay, oxide of iron and marl, carbonate of lime, are added, the power of such mixed soil to retain water is much improved, but the material that has the greatest influence, and the one most within our control is humus or the organic matter of soil. An experiment showed this clearly. A glass funnel was used holding a very small filter paper in its throat (and thoroughly wet) to prevent the sand flowing through. Into this funnel 100 grains of dry sandy soil from Grayling were placed, and water poured over the sand till completely wet, and the excess of water drained off till dripping had ceased. This soil contained 95 per cent of sand and 2¼ per cent humus. It took up and retained by capillary attraction 29 per cent of water. Left undisturbed for three days in the shade it lost 27.7 parts of water, retaining only 1.3 parts out of the 29.

A soil was prepared by mixing two parts of Grayling sand with one part of Kalamazoo muck (containing 63.76 per cent of humus). The materials were thoroughly mixed and sifted and 100 grains of the mixed soils were placed in a glass funnel, the same as in former experiment, and water poured over it till saturated, when it was found that 100 parts of this soil took up and retained 65 parts of water. On leaving it exposed for three days in the same way, the soil lost 45 parts of water, but still retained 20 parts of the original 65. In other words, the addition of 21 per cent of humus to a sand containing 2¼ per cent of organic matter, more than doubled its capacity to take up water by capillarity, and increased by more than 15 fold its power to resist evaporation.

A similar set of experiments, using jelly cups in place of funnels, gave concordant results. It is thus shown that the beneficial influence of the organic matter of the soil in mitigating drought in sandy soils is twofold: assisting such soil to take up and hold the rain when it falls, and preventing excessive loss by evaporation.

The damage by forest fires sweeping over the country, burning up leaves and grasses which would form humus, and consuming much of the humus already in the soil, becomes evident to all. These forest fires inflict incalculable injury upon our northern plains. The thwarting of Nature's efforts at reforesting, by burning up all trees and shrubs too young to resist the fire, is clearly seen as one travels over the blackened country.

Keep out the fires is the first and great commandment in forestry for Michigan. Without this no effort at reforesting will accomplish much.

METEOROLOGICAL OBSERVATIONS FOR THIRTY FOUR YEARS AT THE MICHIGAN AGRICULTURAL COLLEGE.

To satisfactorily study these questions of the relation of climate to forestry, we need a long series of observations taken at leading points in the State. Unfortunately these are wanting, but as a contribution to this end the following mean monthly observations at the Agricultural College are presented. They are too local to be decisive of the average climatic condition of our State, but may yet be of some value in future studies.

Abstract of the Meteorological Observations taken at the State Agricultural College for thirty-four years—from 1864 to 1897.

BY R. C. KEDZIE, Professor of Chemistry.

Year.	JANUARY. Mean Temperature.	JANUARY. Pressure of Vapor.	JANUARY. Relative Humidity.	JANUARY. Barometer reduced to frost point.	JANUARY. Cloudiness.	JANUARY. Rain.	FEBRUARY. Mean Temperature.	FEBRUARY. Pressure of Vapor.	FEBRUARY. Relative Humidity.	FEBRUARY. Barometer reduced to frost point.	FEBRUARY. Cloudiness.	FEBRUARY. Rain.
1864	22.26°	.105	66	28.875	66	0.94	27.32°	.150	70	28.771	69	0.27
1865	21.10	.090	72	28 887	77	0.65	27.59	.118	75	28.949	75	1.76
1866	21.16	.104	82	29.013	74	2.08	22.71	.111	81	28.970	71	2.28
1867	17.61	.091	87	28.857	76	1.68	30.89	.152	85	28.904	71	3.23
1868	19.00	.090	80	28.894	82	1.47	18.72	.093	83	29.014	65	1.28
1869	29.38	.162	96	28.830	66	0.87	26.66	.148	95	28.839	71	2.95
1870	25.37	.125	85	28.867	80	1.93	24.25	.112	84	28.807	65	1.20
1871	24.75	.135	93	28.903	82	3.95	25.65	.132	90	28.816	69	1.73
1872	21.59	.107	88	28.838	71	0.43	21.34	.100	84	28.842	50	0.49
1873	15.87	.099	95	28.873	79	2.98	19.10	.110	95	28.847	61	0.77
1874	27.70	.135	88	29.048	75	3.53	25.51	.128	89	28.928	70	1.55
1875	12.87	.074	88	29.005	76	1.81	27.99	.075	94	28.875	53	2.20
1876	30.22	.157	84	29.073	58	1.63	27.38	.131	84	29.063	58	3.04
1877	18.07	.097	91	29.057	64	1.33	32.31	.155	85	29.124	45	0.00
1878	29.11	.135	89	29.123	76	1.12	28.07	.138	89	29.029	56	2.74
1879	19.19	.099	89	29.130	68	0.49	20.40	.105	92	29.107	73	1.43
1880	37.10	.171	75	28.995	63	2.67	29.19	.144	68	29.007	63	1.62
1881	16.98	.082	81	29.077	65	2.27	21.58	.122	93	29.152	68	3.77
1882	24.89	.125	89	29 144	72	1.47	35.12	.156	75	29.053	56	2.28
1883	14.39	.077	95	29.129	67	1.53	19.76	.106	93	29.252	61	4.50
1884	15.46	.093	93	29.130	77	1.23	23.43	.135	92	29.093	85	3.69
1885	15.34	.113	90	29.144	75	2.70	8.94	.124	91	29.005	49	0.73
1886	18.78	.106	91	29.074	77	2.66	22.27	.132	86	29.106	65	1.35
1887	18.20	.108	90	29.000	71	3.25	24.26	.127	89	29.176	78	5.71
1888	15.40	.085	89	29.202	77	2.18	21.95	.112	85	29.070	64	1.70
1889	28.04	.135	84	29.008	71	1.53	18.25	.092	85	29.091	73	1.17
1890	31.54	.161	87	29.146	72	2.31	31.54	.152	84	29.073	69	1.79
1891	26.72	.137	90	29.092	70	0.82	26.67	.137	81	29.055	68	2.20
1892	19.20	.098	86	29.064	63	0.96	27.30	.139	86	29.133	79	1.93
1893	14.80	.082	82	29.008	78	1.78	21.31	.098	87	29.115	66	1.83
1894	26.88	.131	83	28.989	64	1.37	21.15	.100	77	29.016	58	0.53
1895	17.50	.095	88	28.966	66	1.04	16.40	.091	81	29.055	66	0.12
1896	24.65	.136	96	29.117	76	0.79	24.28	.138	96	28.916	67	1.51
1897	22.34	.136	97	29.124	73	4.17	26.38	.146	97	29.090	80	0.67
Means	21.87	.114	87	29.020	72	1.81	23.69	.124	86	29.010	66	1.88

Abstract of the Meteorological Observations.—Continued.

Year.	MARCH.						APRIL.					
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.
1864	31.74°	.155	77	28.764	68	2.26	45.86°	.275	84	28.843	76	3.87
1865	36.96	.182	74	28.806	68	2.79	47.40	.248	74	28.815	66	2.32
1866	29.06	.140	83	28.959	71	3.39	48.94	.236	64	28.848	57	1.41
1867	29 72	.134	88	28.930	72	0.68	48.20	.196	57	28.752	60	2.19
1868	37.80	.213	87	28.887	63	4.65	43.68	.224	56	28.911	56	1.83
1869	27.60	.124	82	28.934	67	1.65	45.70	.222	67	28.827	61	3.42
1870	30.28	.148	84	28.845	75	3.01	50.39	.267	76	28.902	50	2.02
1871	38.18	.194	83	28.810	66	3.91	49.80	.261	74	28.722	63	2.97
1872	24.75	.109	85	28.911	54	2.04	47.39	.260	74	28.852	52	1.26
1873	28.30	.142	86	28.852	62	1.73	43.17	.220	76	28.798	73	3.88
1874	32.20	.161	83	28.895	54	1.79	36.87	.169	75	28 941	46	1.67
1875	26.20	.136	87	28.844	49	1.02	41.11	.182	69	29.047	45	0.61
1876	30.55	.150	95	28.929	65	4.84	44.16	.195	66	29.000	51	2.08
1877	24.51	.127	91	28.981	63	5.60	46.16	.214	70	28.974	50	4.14
1878	40.90	.219	83	29.072	72	3.12	50.55	.269	69	28.874	59	3.76
1879	33.19	.152	78	29.102	56	1.57	44.84	.195	66	29.050	44	1.25
1880	35.50	.145	79	29.181	56	1.70	45.87	.232	74	28.984	48	6.10
1881	30.28	.145	86	28.899	67	2.66	45.59	.200	71	29.054	49	1.75
1882	35.96	.163	77	29.110	68	3.58	44.70	.202	67	29.101	57	1.88
1883	24.89	.113	93	29.059	48	0.71	43.48	.198	69	29.042	54	1.90
1884	29.89	.149	86	29.083	55	3.67	43.66	.193	68	29.023	57	1.95
1885	21.26	.159	88	29.096	52	0.58	43.59	.223	73	29.097	60	2.47
1886	31.33	.169	80	29.013	60	2.63	50.18	.356	73	29.113	57	1.99
1887	38.29	.124	78	29.118	54	1.78	45.37	.204	66	29.048	58	0.90
1888	27.03	.123	79	29.154	62	1.88	44.03	.179	61	29.202	49	1.15
1889	37.60	.151	72	29.010	51	1.22	46.59	.212	68	29.069	56	2.02
1890	28.20	.129	79	29.100	56	1.54	57.20	.226	68	29.159	46	3.20
1891	29.27	.133	80	29.124	71	2.41	47.44	.237	70	29.060	55	1.74
1892	29.86	.129	77	29.121	52	1.31	44.50	.202	63	29.107	50	2.04
1893	28.16	.148	85	29.063	57	2.82	43.50	.228	75	28.978	71	4.81
1894	40.06	.203	77	29.008	63	1.25	48.44	.249	72	29.055	61	2.76
1895	27.20	.125	80	29.064	54	0.27	48.57	.255	74	29.062	49	0.67
1896	28.70	.159	95	29.052	52	1.31	52.64	.376	84	29.067	46	2.77
1897	33.00	.190	94	29.085	65	2.08	44.58	.282	90	29.143	65	2.74
Means	30.84	.151	83	28.996	61	2.28	46.00	.232	70	28.996	56	2.40

Abstract of the Meteorological Observations.—Continued.

Year.	May.						June.					
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.
1864	60.19°	.470	77	28.787	62	2.87	67.62°	.632	81	28.949	48	3.88
1865	57.65	.373	76	28.807	54	1.77	70.76	.596	82	28.868	54	3.55
1866	55.04	.261	59	28.823	49	3.48	66.60	.488	74	28.783	64	5.37
1867	51.11	.234	62	28.781	69	3.81	71.61	.556	73	28.872	46	2.83
1868	59.08	.336	66	28.822	46	2.80	68.46	.317	76	28.986	45	3.55
1869	56.02	.322	70	28.749	70	2.05	64.45	.496	80	28.856	65	4.40
1870	64.32	.441	73	28.857	39	1.16	70.87	.588	77	28.880	42	7.27
1871	61.39	.405	72	28.904	37	1.97	68.21	.522	74	28.865	42	2.93
1872	58.48	.380	77	28.868	60	3.72	71.82	.616	78	28.879	49	3.45
1873	56.98	.345	72	28.826	58	3.05	70.60	.534	72	28.840	40	2.96
1874	59.58	.323	62	28.844	47	1.77	70.61	.559	75	28.878	54	5.07
1875	60.82	.334	67	29.061	47	4.48	66.57	.467	65	29.029	52	1.84
1876	57.95	.349	73	29.009	52	4.13	68.14	.539	79	28.911	50	4.34
1877	58.25	.337	66	29.056	34	2.23	65.93	.476	75	29.020	51	3.53
1878	54.57	.290	61	29.020	54	3.44	64.08	.441	73	29.030	45	3.15
1879	58.76	.321	64	29.116	40	2.45	66.02	.478	75	29.073	43	2.87
1880	64.30	.533	71	29.061	41	5.59	67.60	.532	79	29.065	47	5.04
1881	65.24	.418	71	29.116	37	2.11	64.31	.472	78	29.018	58	4.37
1882	52.73	.269	66	29.077	53	4.04	66.49	.471	72	28.971	53	5.57
1883	52.78	.289	72	29.007	66	5.66	65.87	.530	81	28.998	62	11.35
1884	56.90	.342	73	29.007	50	3.95	68.92	.527	76	29.268	41	2.83
1885	55.76	.353	67	28.988	55	2.30	64.69	.576	75	29.105	43	6.01
1886	58.06	.457	79	29.036	46	2.67	65.72	.589	73	29.068	47	1.92
1887	64.28	.401	68	29.096	36	2.42	68.53	.500	73	29.107	47	2.47
1888	53.65	.305	68	29.023	64	3.66	67.89	.497	72	29.032	44	2.51
1889	57.37	.269	64	29.009	52	3.61	62.83	.439	79	29.057	65	3.42
1890	53.70	.299	70	28.960	58	4.98	70.30	.532	73	29.083	50	3.92
1891	55.69	.275	61	29.164	36	1.63	67.40	.493	73	29.062	50	2.55
1892	54.50	.322	76	29.003	70	5.92	67.70	.561	83	29.019	59	4.33
1893	54.40	.316	75	28.984	52	2.86	66.60	.532	78	28.767	40	4.85
1894	56.94	.355	75	28.987	62	4.83	71.38	.551	72	29.039	42	1.30
1895	61.80	.392	67	29.098	46	2.06	71.40	.521	68	29.151	40	1.01
1896	66.48	.547	83	29.035	41	3.14	69.87	.622	63	29.060	44	2.60
1897	55.79	.421	90	29.089	49	3.29	64.21	.562	88	29.050	52	2.57
Means	57.96	.356	70	28.973	51	3.23	67.77	.524	76	28.989	49	3.52

Abstract of the Meterological Observations.—Continued.

Year.	JULY.						AUGUST.					
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.
1864	74.52°	.788	80	28.925	46	1.25	70.72°	.558	82	28.854	68	0.39
1865	65.60	.535	85	28.788	64	3.91	65.84	.542	85	28.953	53	3.38
1866	71.72	.629	74	28.905	52	4.19	62.60	.464	81	28.884	66	3.44
1867	71.60	.547	70	28.915	44	1.78	69.78	.522	74	28.911	39	1.74
1868	77.19	.782	77	28.912	44	1.11	70.33	.545	73	28.943	50	2.42
1869	70.35	.590	79	28.844	53	5.77	70.58	.598	75	28.968	48	4.85
1870	71.40	.659	79	28.836	48	8.02	70.11	.594	81	28.890	50	5.53
1871	70.60	.579	77	28.891	49	3.10	71.19	.586	78	28.907	44	1.42
1872	74.91	.671	77	28.924	47	3.36	71.22	.650	83	28.967	50	4.18
1873	70.82	.575	75	28.914	51	5.12	69.49	.559	79	28.927	45	0.80
1874	72.02	.539	71	28.907	37	2.56	69.39	.527	74	28.924	31	1.28
1875	69.67	.535	78	29.044	46	2.42	65.48	.470	77	29.025	47	1.47
1876	72.48	.617	78	29.009	46	2.10	71.55	.576	76	29.048	43	1.28
1877	71.43	.522	70	29.062	44	2.25	68.46	.519	78	29.046	49	6.57
1878	73.04	.639	68	29.084	37	2.96	70.15	.535	74	29.009	40	1.85
1879	74.03	.573	71	29.057	36	2.19	70.00	.494	70	29.100	35	1.61
1880	68.04	.559	78	29.069	45	6.27	68.58	.571	82	29.126	52	6.02
1881	73.14	.590	73	29.093	38	1.81	72.69	.540	70	29.107	40	1.63
1882	67.71	.485	72	29.108	43	2.32	69.52	.603	83	29.074	54	5.72
1883	68.94	.569	80	29.072	54	11.27	64.90	.452	74	29.154	34	0.18
1884	67.95	.524	76	29.016	46	2.60	66.91	.498	75	29.132	36	1.30
1885	72.70	.599	71	29.052	43	2.52	63.62	.545	80	29.061	52	5.82
1886	70.68	.711	65	29.064	48	0.65	69.30	.665	71	29.062	44	4.69
1887	75.51	.556	65	29.104	36	1.50	67.96	.427	66	29.117	48	0.89
1888	70.53	.514	71	29.119	43	2.40	67.55	.476	71	29.103	42	1.87
1889	70.19	.579	78	29.141	42	3.41	68.56	.493	71	29.070	32	0.68
1890	71.07	.481	65	29.104	33	0.92	65.40	.452	71	29.137	42	3.60
1891	65.30	.432	70	29.109	37	1.88	67.93	.479	67	29.134	44	4.82
1892	70.29	.539	73	29.178	32	2.00	68.30	.521	75	29.111	37	5.12
1893	71.50	.571	75	29.069	39	1.86	68.10	.537	78	29.119	31	0.56
1894	73.22	.559	65	29.064	29	0.86	68.80	.591	83	29.085	42	0.00
1895	70.50	.525	72	29.102	45	1.47	71.20	.616	80	29.050	41	4.64
1896	71.83	.701	88	29.070	53	6.73	69.99	.683	89	29.087	45	4.73
1897	73.79	.743	88	29.017	32	8.49	65.94	.566	88	29.066	29	1.69
Means	71.39	.589	75	29.017	44	3.27	68.59	.543	77	29.034	44	2.80

Abstract of the Meteorological Observations.—Continued.

Year.	September.						October.					
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.
1864	59.62°	.475	81	28.902	66	3.53	45.74°	.256	80	28.824	72	1.85
1865	67.66	.522	88	28.954	63	4.79	46.50	.265	83	28.905	54	2.79
1866	55.80	.407	85	28.956	64	5.81	49.50	.307	82	28.979	66	3.57
1867	56.60	.438	77	29.000	37	1.42	50.60	.285	77	28.960	45	2.11
1868	58.77	.373	80	28.936	59	2.95	45.19	.240	73	29.000	57	1.11
1969	63.45	.459	83	29.020	41	1.43	40.80	.219	86	28.920	68	1.72
1870	63.66	.490	83	29.022	51	2.85	52.45	.346	85	28.939	66	2.29
1871	59.10	.391	78	29.038	48	0.79	53.91	.307	72	28.909	53	1.43
1872	62.03	.498	85	28.890	48	5.21	47.44	.295	84	28.979	47	0.67
1873	67.38	.383	80	28.928	48	3.50	44.68	.245	80	28.917	55	1.91
1874	62.85	.422	86	28.964	36	1.27	49.10	.282	78	28.953	58	0.49
1875	58.50	.388	76	29.031	51	2.89	42.93	.219	76	29.016	64	5.81
1876	56.30	.391	83	28.995	57	3.65	43.74	.220	76	28.929	59	1.26
1877	61.28	.430	80	29.121	36	1.38	50.83	.314	83	29.077	66	5.69
1878	63.15	.477	78	29.156	45	3.43	48.33	.269	76	29.080	54	1.99
1879	56 21	.356	78	29.152	47	3.19	57.28	.395	76	29.160	55	1.57
1880	55.83	.439	74	29.098	46	3.10	46.23	.260	81	26.130	52	2.51
1881	69 69	.515	73	29.077	50	2.91	52.51	.346	84	29.181	67	5.56
1882	59.98	.429	83	29.198	43	0.67	52.67	.330	81	29.124	50	2.64
1883	56.43	.360	78	29.162	53	2.34	46.17	.256	78	29.158	70	3.66
1884	65.06	.481	76	29.130	36	3.34	50.91	.322	80	29.195	53	5.73
1885	58.94	.431	78	29.215	44	3.75	44.95	.283	83	29.056	60	3.08
1886	62.07	.539	80	29.148	55	5.40	52.37	.370	73	29.266	49	0.95
1887	58.86	.373	75	29.200	48	4.72	44.97	.237	75	29.103	60	1.86
1888	57.76	.327	71	29.128	45	1.89	45.70	.238	76	29.027	70	3.00
1889	61.14	.379	72	29.157	40	0.79	44.19	.184	69	29.061	64	0.65
1890	57.70	.367	76	29.230	48	1.67	49.11	.284	80	28.981	70	4.56
1891	65.10	.470	72	29.222	35	1.10	41.81	.252	71	29.158	51	0.82
1892	60.80	.418	77	29.132	41	2.17	48.30	.281	78	29.096	42	0.78
1893	58.40	.463	88	28.993	42	1.84	49.70	.311	81	28.980	45	3.61
1894	63.66	.491	80	29.103	45	2.59	49.80	.308	85	28.982	67	1.91
1895	66.60	.568	82	29.158	32	0.85	45.00	.274	86	29.084	41	1.41
1896	57.62	.459	92	29.064	60	6.73	44.61	.282	89	29.090	42	1.06
1897	62.92	.535	87	29.267	19	0 80	53.06	.375	88	29.227	30	2.75
Means	60.91	.439	80	29.081	46	2.79	48.18	.28	80	28 954	57	2.42

Abstract of the Meteorological Observations.—Continued.

Year.	NOVEMBER.						DECEMBER.					
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain.
1864	37.88°	.193	77	28.814	73	4.12	24.37°	.111	73	28.777	77	3.20
1865	38.63	.193	81	28.947	54	0.68	26.72	.121	80	28.891	75	1.43
1866	37.94	.189	81	28.946	71	2.60	25.53	.123	79	28.893	76	1.90
1867	40.44	.192	72	28.832	56	1.77	25.31	.118	76	28.868	78	1.34
1868	36.77	.193	84	28.909	70	2.44	21.16	.114	90	28.958	74	1.35
1869	32.05	.156	86	28.863	77	1.92	28.16	.126	82	28.999	78	2.11
1870	38.40	.187	80	28.903	54	0.91	24.80	.139	94	28.772	79	2.57
1871	31.95	.160	86	28.964	69	1.25	21.12	.108	86	28.880	81	1.76
1872	29.80	.158	89	28.881	69	0.98	15.74	.092	91	28.992	72	1.06
1873	28.49	.148	89	28.833	75	2.03	29.54	.158	89	28.929	75	3.02
1874	35.00	.145	77	28.937	63	1.61	26.96	.135	85	29.001	65	0.37
1875	32.96	.155	84	29.054	67	1.11	31.58	.172	80	28.955	75	2.80
1876	36.33	.191	85	28.953	80	0.91	15.23	.088	92	29.203	72	1.29
1877	35.24	.188	87	29.099	73	3.67	36.57	.203	89	29.180	71	1.03
1878	36.29	.188	87	29.081	68	2.16	21.29	.108	95	29.147	89	2.27
1879	38.22	.198	75	29.027	68	4.55	27.46	.129	80	29.032	84	3.55
1880	27.45	.143	89	29.192	70	2.32	22.07	.118	91	29.155	77	0.85
1881	38.20	.190	79	29.129	74	4.09	34.31	.168	84	29.134	67	1.75
1882	36.30	.195	85	29.187	75	1.83	24.80	.128	92	28.124	86	0.88
1883	36.08	.194	80	29.128	58	3.98	26.39	.130	86	29.124	65	1.28
1884	34.11	.169	83	29.123	61	1.84	24.71	.140	90	29.139	87	4.15
1885	37.22	.178	84	29.013	79	2.90	27.75	.124	90	29.062	82	2.14
1886	33.94	.182	78	29.061	64	1.48	19.74	.105	87	29.186	69	1.56
1887	35.66	.161	80	29.096	55	2.28	27.30	.131	87	29.096	74	3.32
1888	38.50	.196	82	29.167	62	3.12	30.39	.145	83	29.070	72	1.20
1889	37.39	.193	84	29.061	72	2.67	36.75	.184	82	29.063	55	2.61
1890	39.06	.185	77	29.081	57	2.30	26.45	.114	81	29.093	62	1.12
1891	33.90	.175	81	29.097	80	3.34	34.55	.160	78	29.074	56	1.47
1892	34.20	.169	83	29.098	82	1.84	25.59	.113	89	29.092	83	1.52
1893	35.63	.183	87	28.998	62	2.19	27.60	.294	83	28.984	79	2.28
1894	32.48	.164	86	29.056	74	0.97	30.12	.157	86	29.075	68	0.93
1895	35.40	.204	90	29.122	63	3.87	28.50	.161	92	29.008	70	5.30
1896	37.09	.231	92	29.112	71	1.05	28.13	.152	91	29.047	74	0.80
1897	36.49	.204	89	29.154	63	2.94	52.62	.148	96	29.095	72	2.02
Means	34.51	.181	83	29.027	68	2.29	26.54	.139	86	29.032	72	1.95

Abstract of the Meterological Observations.—Recapitulation.

Years.	The Year.						
	Mean Temperature.	Pressure of Vapor.	Relative Humidity.	Barometer reduced to frost point.	Cloudiness.	Rain and melted snow.	Snow in inches.
1864	48.99°	.347	76	28.960	66	28.37	31.5
1865	47.70	.313	80	29.001	63	29.82	30.0
1866	45.61	.264	77	29.033	65	39.51	42.5
1867	46.95	.297	75	29.002	55	24.58	52.0
1868	46.34	.293	79	29.051	59	26.45	56.5
1869	46.27	.302	82	29.007	59	33.17	56.0
1870	49.10	.347	83	28.996	58	37.76	54.0
1871	49.90	.307	80	28.988	59	27.21	54.0
1872	45.54	.328	82	29.007	57	26.84	42.5
1873	41.54	.285	82	28.994	60	31.74	75.5
1874	47.05	.277	79	29.055	53	32.00	32.0
1875	43.06	.267	79	28.998	56	28.24	63.5
1876	46.17	.300	81	29.049	58	30.55	46.5
1877	47.42	.299	80	29.066	54	37.42	2.56
1878	48.29	.308	78	29.054	58	31.19	61.0
1879	46.88	.291	76	29.080	54	26.82	30.0
1880	47.32	.337	75	29.103	55	43.98	29.5
1881	47.88	.318	79	29.086	57	34.66	77.5
1882	47.56	.296	78	29.106	59	32.88	30.5
1883	43.51	.273	81	29.107	58	48.36	41.0
1884	45.66	.298	81	29.111	57	36.28	45.0
1885	42.90	.303	81	29.075	58	35.00	57.0
1886	46.20	.365	78	29.101	57	29.95	57.0
1887	46.60	.279	76	29.105	55	31.10	4.0
1888	45.03	.266	76	29.108	58	26.56	26.75
1889	47.43	.273	74	29.073	56	23.78	38.5
1890	47.61	.282	76	29.095	55	31.91	14.75
1891	47.40	.232	70	29.113	59	24.78	29.75
1892	45.88	.291	78	29.096	58	29.92	30.5
1893	44.97	.313	81	29.006	55	31.29	58.35
1894	48.5	.322	78	29.038	56	19.30	20.38
1895	46.67	.319	80	29.077	51	22.80	49.14
1896	47.99	.374	90	29.057	56	35.20	35.75
1897	47.01	.359	91	29.117	52	33.61	39.63
Means	46.56	.304	79	29.059	57	31.27	46.00

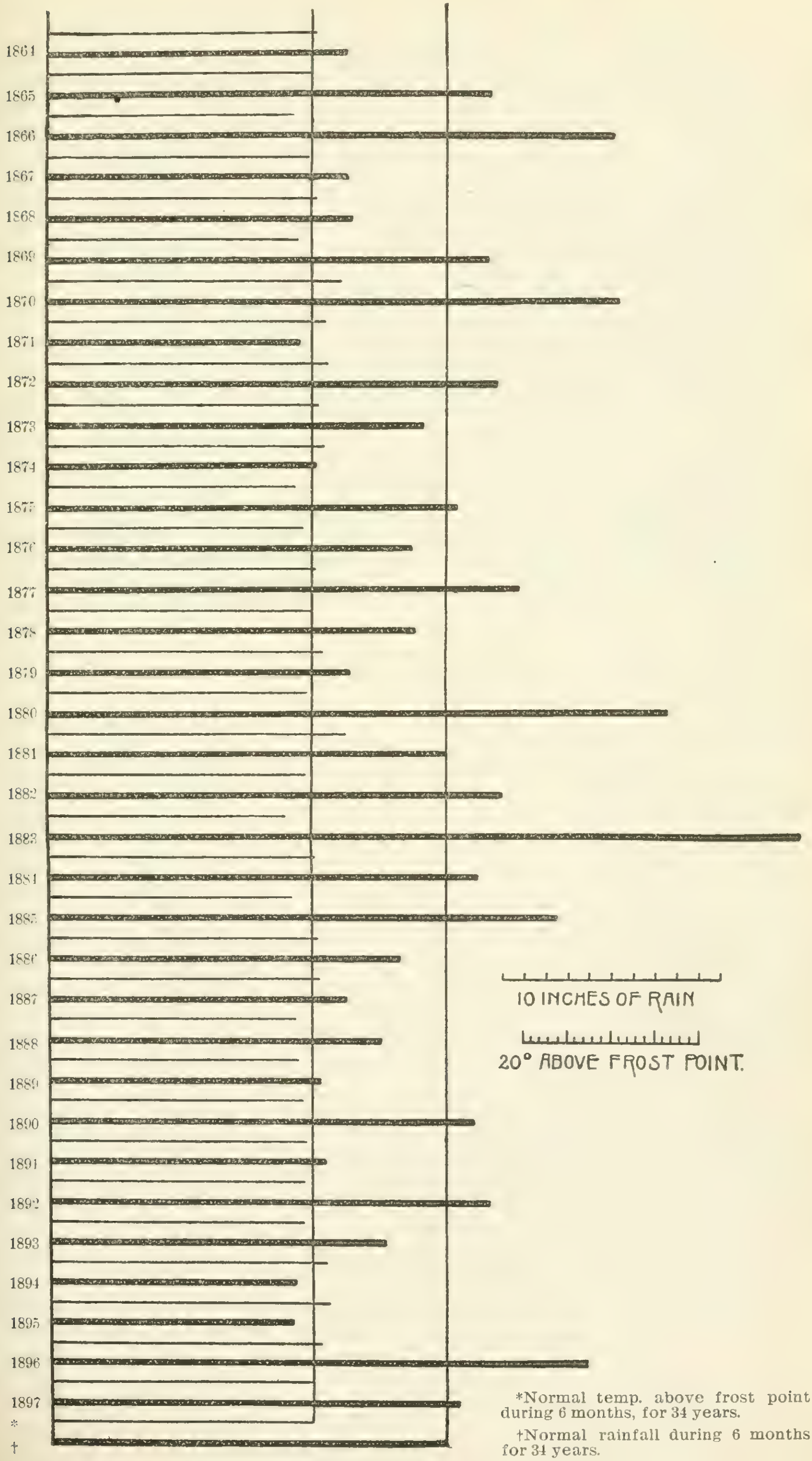
THE ACTIVE SEASON OF GROWTH.

The period of active growth of trees in Michigan is the six months from May to October. The cold season both as regards temperature and precipitation of atmospheric moisture has a small influence on forest growth.

A table is here presented giving the mean rainfall in inches for the six months of each year, and the monthly temperature for the year.

Temperature and rainfall for May-October inclusive, years 1864 to 1897.

Years	May.		June.		July.		August.		September.		October.		Average monthly temperature.	Total rainfall.	Average monthly rainfall.
	Mean temperature.	Rainfall.	Mean temperature.	Rainfall.	Mean temperature.	Rainfall.	Mean temperature.	Rainfall.	Mean temperature.	Rainfall.	Mean temperature.	Rainfall.			
1864	60.19°	2.87	67.62°	3.88	74.52°	1.25	70.72°	0.39	59.62°	3.52	45.74°	1.85	63.07°	13.76	2.29
1865	57.65	1.77	70.76	3.55	65.60	3.91	65.84	3.38	67.66	4.79	46.50	2.79	62.33	20.19	3.37
1866	55.04	3.48	66.60	5.37	71.72	4.19	62.60	3.44	55.80	5.81	49.50	3.57	60.21	25.86	4.31
1867	51.11	3.81	71.61	2.83	71.60	1.78	69.78	1.74	56.60	1.42	50.60	2.11	61.88	13.69	2.28
1868	59.08	2.80	68.46	3.55	77.19	1.11	70.33	2.42	58.77	2.95	45.19	1.11	63.00	13.94	2.32
1869	56.02	2.05	64.45	4.40	70.35	5.77	70.58	4.85	63.45	1.43	40.80	1.72	60.94	20.22	3.37
1870	64.32	1.16	70.87	7.27	74.40	8.02	70.11	4.53	63.66	2.85	52.45	2.29	65.97	26.12	4.35
1871	61.39	1.97	68.21	2.93	70.60	3.10	71.19	1.42	59.10	0.79	53.91	1.43	64.07	11.64	1.94
1872	58.48	3.72	71.82	3.45	74.91	3.36	71.22	4.18	62.03	5.21	47.44	0.67	64.32	20.59	3.43
1873	56.98	3.05	70.60	2.96	70.82	5.12	69.49	0.80	67.38	3.50	44.68	1.91	63.32	17.34	2.89
1874	59.58	1.77	70.61	5.07	72.02	2.56	69.39	1.28	62.85	1.27	49.10	0.49	63.92	12.44	2.07
1875	60.82	4.48	66.57	1.84	69.67	2.42	65.48	1.47	58.50	2.89	42.93	5.81	60.66	18.91	3.15
1876	57.95	4.13	68.14	4.34	72.48	2.10	71.55	1.28	56.30	3.65	43.74	1.26	61.69	16.76	2.79
1877	58.25	2.23	65.93	3.53	71.43	2.25	68.46	6.57	61.28	1.38	50.83	5.69	62.70	21.65	3.61
1878	54.57	3.44	64.08	3.15	73.04	2.96	70.15	1.85	63.15	3.43	48.33	1.99	62.22	16.82	2.80
1879	58.76	2.45	66.02	2.87	74.03	2.19	70.00	1.61	56.21	3.19	57.28	1.57	63.72	13.88	2.31
1880	64.30	5.59	67.60	5.04	68.04	6.27	68.58	6.02	55.83	3.10	46.23	2.51	61.76	28.53	4.75
1881	65.24	2.11	64.31	4.37	73.14	1.81	72.69	1.63	69.69	2.91	52.51	5.56	66.26	18.39	3.07
1882	52.73	4.04	66.49	5.57	67.71	2.32	69.52	5.72	59.98	0.67	52.67	2.64	61.52	20.96	3.49
1883	52.78	5.66	65.87	11.35	68.94	11.27	64.90	0.18	56.43	2.34	46.17	3.66	59.18	34.46	5.74
1884	56.90	3.95	68.92	2.83	67.95	2.60	66.91	1.30	65.06	3.34	50.91	5.73	62.77	19.75	3.29
1885	55.76	2.30	64.69	6.01	72.70	2.52	63.62	5.82	58.94	3.75	44.95	3.08	60.11	23.48	3.91
1886	58.06	2.67	65.72	1.92	70.68	0.65	69.30	4.69	62.07	5.40	52.37	0.95	63.03	16.28	2.71
1887	64.28	2.42	68.53	2.47	75.51	1.50	67.96	0.89	58.86	4.72	44.97	1.86	63.35	13.86	2.31
1888	53.65	3.66	67.89	2.51	70.53	2.40	67.55	1.87	57.76	1.89	45.70	3.00	60.51	15.33	2.56
1889	57.37	3.61	62.83	3.42	70.19	3.41	68.56	0.68	61.24	0.79	44.19	0.65	60.73	12.56	2.09
1890	53.70	4.98	70.30	3.92	71.07	0.92	65.40	3.60	57.70	1.67	49.11	4.56	61.21	19.65	3.28
1891	55.69	1.63	67.40	2.55	65.30	1.88	67.93	4.82	65.10	1.10	48.81	0.82	61.70	12.80	2.13
1892	54.50	5.92	67.70	4.33	70.19	2.00	68.30	5.12	60.80	2.17	48.30	0.78	61.35	20.32	3.10
1893	54.40	2.86	66.60	4.85	71.50	1.86	68.10	0.56	58.40	1.84	49.70	3.61	61.45	15.58	2.68
1894	56.94	4.83	71.38	1.30	73.22	0.86	68.80	0.00	63.66	2.59	49.80	1.91	63.96	11.49	1.92
1895	61.80	2.06	71.40	1.01	70.50	1.47	71.20	4.64	66.60	0.85	45.00	1.41	64.42	11.44	1.91
1896	66.48	3.14	69.87	2.60	71.83	6.73	69.99	4.73	57.62	6.73	44.61	1.06	63.40	24.99	4.17
1897	55.79	3.29	64.21	2.57	73.79	8.49	65.94	1.69	62.92	0.80	53.06	2.15	62.62	18.99	3.17
Means	57.96	3.23	67.77	3.52	71.39	3.27	68.59	2.80	60.91	2.79	48.18	2.42	62.45	18.31	3.05



*Normal temp. above frost point during 6 months, for 34 years.

†Normal rainfall during 6 months for 34 years.

VARIABLE CLIMATE.

The climate of Michigan is subject to wide variations, especially in the rainfall. The average rainfall, including snow, is 31.27 inches at the Agricultural College, yet in 1894 the rainfall was only 19.3 inches, while in 1883 is was 48.36 inches. The fluctuations in temperature are less, the mean temperature being 46.56, yet in 1871 it was 49.90, while in 1873 it was 41.54 degrees, or more than eight degrees colder.

To enable one to see at a glance the fluctuations in rainfall, and in temperature above the frost point for the six growing months, from May to October, the above plate is inserted. The heavy black horizontal line denotes the relative amount of rainfall for the six months, while the vertical heavy black line shows the normal rainfall for the period. The light horizontal line shows the relative temperature above frost point for the six months of the year, and the light vertical line shows the normal temperature above frost point for the same period.

The changes from year to year in the amount of rainfall are so great as to be confusing in studying the weather. To equalize this in some degree and see whether our climate is changing, the results are recast in periods of five years, both in the annual rainfall and in that for six months of the active growing season:

Inches of mean rainfall by periods:	Year.	6 months.
1864 to 1868	31.70	17.67
1869 to 1873	31.34	19.18
1874 to 1878	31.88	17.23
1879 to 1883	37.34	23.24
1884 to 1888	31.78	17.34
1889 to 1893	28.34	18.22
1894 to 1897	27.73	18.73

PROXIMITY TO THE GREAT LAKES.

The influence of the great lakes on the climate of neighboring land, especially when the prevailing winds blow from the water over the land, is recognized. To show the extent of this influence as far as possible, observations were consulted in the office of the State Weather Bureau, and by the kindness of Director Schneider, are here presented. They cover a period of ten years past, and embrace the mean temperature and rainfall for the six months—May to October:

	Temperature.	Rainfall.
Grand Haven, Ottawa Co	60.60	18.38
Hart, Oceana Co	60.71	17.06
Ivan, Kalkaska Co	59.40	17.33
Charlevoix, Charlevoix Co	59.39	16.83
Cheboygan, Cheboygan Co	57.45	18.00
Alpena, Alpena Co	56.63	19.89
Harrisville, Alcona Co	59.48	18.15
Jeddo, Sanilac Co	61.41	16.46
Port Huron, St. Clair Co	60.53	16.91
Grayling, Crawford Co	58.18	14.11
Ovid, Clinton Co	61.60	15.70
Alma, Gratiot Co	61.03	16.86
Flint, Genesee Co	60.90	13.84
Agricultural College, Ingham Co	61.13	16.31

A progressive fall in temperature is to be expected as we pass northward. The variation in the amount of rainfall for the active six months is a matter of interest. Note the rainfall at Ivan (17.33), at Grayling (14.11) and at Harrisville (18.15), all of them in the same tier of counties. Also at Grand Haven (18.38), at Ovid (15.70), at Flint (13.84) and at Port Huron (16.91)—all in the same tier of counties, reaching across the State from west to east.

FORESTRY LEGISLATION.

CLINTON D. SMITH.

In Michigan, as early as 1846, a law was enacted (Howell's Annotated Statutes 9,402, 9,403 and 9,404) making it a misdemeanor to wilfully or negligently set fire to any woods, prairies or ground not the property of the person committing the deed, or wilfully or negligently permitting any fire to pass from his own woods, prairies or grounds, to the injury or destruction of the property of other persons. The maximum penalty is a fine of $1,000 or imprisonment in the county jail not exceeding one year. The guilty person is also liable to the party injured in double the amount of the damages sustained.

"Whenever the woods or prairies of any township shall be on fire so as to endanger property, it shall be the duty of the justices of the peace, the supervisor, and the commissioner of highways of such township, and each of them, to order such, and so many of the inhabitants of such township, liable to work on the highways, and residing in the vicinity of the place where such fire shall be, as they shall severally deem necessary, to repair to the place where such fire shall prevail, and there to assist in extinguishing the same, or in stopping its progress. If any person shall refuse or wilfully neglect to comply with such order, he shall forfeit a sum not less than five nor more than fifty dollars."

An act, approved May 29, 1897, adds three more sections to these statutes, as follows:

Sec. 9404 a. (Sec. 4.) "The township boards of the several townships of this State are hereby authorized, and it shall be their duty to prohibit the setting of forest fires or fires for the purpose of clearing lands, and disposing by burning, of refuse material and waste matter within their respective jurisdictions, whenever, in the judgment of a majority of the members of each of said boards, it shall be deemed necessary to prevent the spreading of such fires over the territory of such township, or any part thereof. Each of such boards may make such rules and regulations as it may deem proper for the purpose of carrying this act into effect, which rules and regulations shall be published by posting notices thereof, together with a copy of this act, in five of the most public places in such township."

Sec. 9404 b. (Sec. 5.) "Whenever in pursuance of the authority hereby given, any township board shall designate a period during which it shall be unlawful to set such fires, any person who shall be found guilty of violating the order of such board by setting any such fire in such township contrary to the provisions of any section of this act, shall be deemed guilty of a misdemeanor, and on conviction thereof, shall be subject to the same punishment as is prescribed in section one of this chapter: Provided, That any person desiring to dispose of refuse material by burning the same during the time prohibited by the board of such township, may do so after first procuring permission in writing, signed by the supervisor and township clerk, or by a majority of such township board, and the said supervisor and township clerk, or a majority of the said board, are hereby authorized to grant such permission, in their discretion, under such conditions as they may prescribe, upon application, made in writing, for such purpose: Provided, further, That said board is hereby authorized at any time to repeal by resolution any action theretofore taken by them under the provisions of this act."

Sec. 9404 c. (Sec. 6.) "Hereafter it shall be the duty of every person residing north of parallel forty-four of north latitude, before setting fire for any of the above mentioned purposes, to serve a notice in writing on every resident owner or occupant of lands or grounds immediately adjoining the tract upon which such fires are to be set, at least one full day previous to the setting of such fires, personally, or by leaving the same at the residence of such adjoining owner or occupant, in the presence of some member of the family of suitable age and discretion, who shall be informed of the contents, and neglecting to give such notice, shall be deemed prima facie evidence of negligence on the part of the person so offending."

The laws passed in 1857 in regard to trespassers on the public lands are still in force. They are found in sections 9405 to 9414 of Howell's Annotated Statutes. These sections declare it to be a felony to knowingly enter upon any of the public lands of this State to cut down or destroy trees growing thereon. If the value of the trees so cut down exceeds twenty-five dollars, the maximum penalty is fixed at five years' imprisonment at hard labor in the State Prison, or by fine not less than one hundred nor more than two thousand dollars. Whoever shall take away any timber or lumber from the State lands is deemed guilty of a felony, and upon conviction, is fined not less than a hundred nor more than two thousand dollars, and is also liable to imprisonment for not less than three nor more than twelve months, or imprisonment alone for not more than five years. If the value of the trees cut down or destroyed be less than twenty-five dollars, the punishment is fixed and may be either imprisonment not less than three months nor more than a year, or fine of not less than fifty nor more than one hundred dollars and imprisonment for a period not to exceed three months.

Whenever timber upon the public lands has been destroyed the prosecution of the supposed offender is begun by preliminary examination, had within the county where the alleged offense was committed. When the accused person is held for trial upon such preliminary examination, the subsequent proceedings may take place either in the county where the offense was committed or in some other county to which the venue is changed by the circuit court.

The law further provides that if any owner of a sawmill or his agent receives and saws logs knowing them to have been stolen from the public domain he shall be deemed guilty of a felony, and shall receive the same punishment as would have been inflicted had he been the original timber thief.

It is the duty of the prosecuting attorney of the county to promptly report to the Commissioner of the State Land Office all trespasses committed upon public lands in his county which may come to his knowledge and it is his further duty when directed by the Commissioner both to prosecute all actions for trespass or injury to the public lands and to advise the Commissioner and give opinions upon all questions of law which the Commissioner may submit to him.

It is evident that the Michigan forests are not unprotected for lack of legislation. Existing statutes provide means both for preventing depredations upon the public domain and for employing the inhabitants of the vicinity in suppressing forest fires. If the public lands are defenseless that condition arises rather from lack of enforcement of the law than from want of legislation. What is wanted in the communities surrounding the public lands is a public spirit which will convict offenders when found guilty, and will aid in the prevention of crimes against the public by making such offenders unpopular and retribution certain. One would hesitate long before recommending that the enforcement of the law be placed in the hands of State agents rather than local officers were it not that the experience of forestry management both in this State and elsewhere had demonstrated the necessity of such a course. The difficulty of enforcing a law for the protection of public property is too great to be left in the hands of local officers who have every temptation to favor the trespassers.

In Other States.—The Division of Forestry of the United States Department of Agriculture has brought together in Circulars Nos. 13 and 17, the recent legislation on State forestry commissions and forest reserves.

The legislature of the state of New York passed in 1897 an act to provide for the acquisition of land in the territory embraced in the Adirondack Park and making an appropriation therefor. By the first section of the act the Governor of the state was directed to appoint from the Commissioners of Fisheries, Game and Forests, and the Commissioner of the State Land Office, three persons to constitute a board which is known as the Forest Preserve Board, the members of which receive no compensation except their actual and necessary expenses. The duties of the board relate to the acquisition for the State, by purchaser or otherwise, of such of the lands and waters embraced in the Adirondack Park as it may deem advisable for the interest of the State. The State is securing title to a large body of land already covered with timber and located at the head waters of its principal rivers. A portion of this land has been lumbered, it is true, but it is still well covered with young and growing timber.

Beginning on page 1 of Circular No. 17 of the United States Division of Forestry, there is the following epitome of the New York forestry law:

"The original forest commission of the state of New York appointed under the act of May 15, 1885, was superseded in 1895 by the Commission of Fisheries, Game and Forests, under the law of April 25, 1895. This law is a comprehensive measure in which allied interests are brought under the control of a single board. Under this law the commission consists of five members, appointed by the Governor, with the consent of the senate, the term of office being five years. The president, who is designated as such by the Governor, receives a salary of $5,000 per year and traveling expenses, and devotes all of his time to the work of his office. The remaining four commissioners receive $1,000 per year and traveling expenses. The board holds at least four meetings on designated days each year. It has a secretary at $2,000 per year, and necessary clerical force. The duties of the board are to propagate and distribute food-fish and game; to enforce all laws for the protection of fish and game and for the protection and preservation of the forest reserve. It has full control of the Adirondack Park and forest reserve, and is authorized to make rules for its care and safety.

"The commissioner appoints thirty-five 'Fish and Game Protectors and Foresters' (hereafter called Foresters) one of whom to be known as chief, and two others as his assistants, the chief to have the control and direction of the entire force. The Foresters give bonds for the proper discharge of their duties. The Chief Forester receives $2,000 per year and traveling expenses; the assistant Foresters $1,200 each, and the remaining Foresters $500 each; all having an extra allowance for traveling expenses and each of them to receive one-half of all fines collected in actions brought upon information furnished by them. It is their duty to enforce all laws and regulations of the commission for the protection of fish and game and for the protection and preservation of the forest reserve and all rules and regulations for the care of the Adirondack Park. They have full power to execute all warrants and search warrants and to serve subpoenas.

"Article XII, chapter 395, laws of 1895, describes the forest preserve (Sec. 270), and defines the powers and duties of the commission (Sec. 271), whose duty it is (1) to have the care, custody, control, and superintendence of the forest preserve; (2) maintain, protect and promote the growth of the forest in the preserve; (3) have charge of the public interest of the State in regard to forests and tree planting, and especially with reference to forest fires in every part of the State; (4) possess all the powers relating to the preserve which were vested in the Commissioners of the Land Office and in the Comptroller on May 15, 1885; (5) prescribe rules and regulations affecting the whole or any part of the preserve for its use, care and administration, and alter or amend the same, but neither such rules or regulations nor anything contained in this article shall prevent or operate to prevent the free use of any roads, streams, or water as the same may have been heretofore used, or may be reasonably required in the prosecution of any lawful business; (6) take measures, for the awakening of an interest in forestry in the schools, and imparting elementary instruction on such subjects therein, and issue tracts and circulars for the care of private woodlands, etc.; (7) print and post rules for the prevention and suppression of forest fires."

By a law passed in April, 1898, a College of Forestry was founded at the Cornell University. Thirty thousand acres of land in the Adirondack Park are set aside for the use of this college as an experimental area. An annual appropriation supplies the college with sufficient funds.

The Minnesota forestry law is modeled after the laws of New York and Maine. All of these laws entrust the enforcement to some responsible officer. The chief features of the Minnesota law follow:

The law is entitled "An act to provide for the preservation of forests of this State, and for the prevention and suppression of forest and prairie fires."

Section 1, enacts that the State Auditor shall be forest commissioner. The supervisors of towns, mayors of cities and presidents of village councils are constituted fire wardens of their respective localities, but the chief fire warden may appoint such other persons as he may deem necessary as fire wardens in unorganized territory.

The sections following provide that the forest commissioner shall appoint a competent deputy to be known as chief fire warden, who is to receive a salary of twelve hundred dollars per year. He is a trained forester and it is his duty to enforce the provisions of the law. He has general charge of the fire warden force of the State and can mass it at any special point to suppress fires. He can appoint, temporarily, needed fire wardens in cases of large fires and divides into five districts all unorganized territories of the State and appoints competent fire wardens therein. He investigates the extent of the forests, the amount and varieties of timber, the damages done to them from time to time by forest fires, the causes of such fires, the methods used to promote the regrowth of timber and any other important facts relating to forest interests which may be required by the forest commissioner. He makes an annual report including the information so gathered and his suggestions.

It is made the duty of all fire wardens to post in conspicuous places in their respective districts warning placards containing abstracts of the forest law, rules and regulations that accord therewith as promulgated by the forest commissioner who furnishes the placards.

During the dry season when fires are liable to occur, the chief fire warden is authorized to use such means as he may deem necessary to prevent or suppress such fires at the expense of the State, but his expenditures in one year are not to exceed five thousand dollars.

It is the duty of the fire warden to take precautions to prevent the starting of forest or prairie fires and, when fire threatens, to go to the place of danger, to call to his assistance able-bodied men, and if any such person refuses to assist, or if the fire warden himself neglects to perform the duties assigned him, such officer or person is deemed guilty of a misdemeanor and upon conviction is punished by a fine of not more than a hundred dollars or by imprisonment for three months.

The chief fire warden and the local fire wardens are given authority to arrest without warrant any person violating the provisions of the act and to take the offender before a magistrate and make complaint against him. It is made the duty of the fire wardens to inquire into the cause of each forest or prairie fire within their district and to report the same to the chief fire warden, with the method used to control such fires, the amount of property destroyed, the number of lives lost and such other facts as the chief fire warden may require.

The fire wardens receive for actual services two dollars per day, two-thirds of which is paid by the county and one-third by the State. The other employees receive one dollar and fifty cents per day. It is provided, however, that no fire warden shall be paid in any one year for more than ten days service in extinguishing or preventing forest or prairie fires, nor more than five days' services in posting notices and making reports. No county shall expend more than five hundred dollars of public money in any one year under this act.

Any person who wilfully or carelessly causes to be set on fire any woods or prairies by means whereof the property of another is injured, is guilty of a misdemeanor and upon conviction is punished by a fine not exceeding a hundred dollars or by imprisonment not exceeding three months. If the act is malicious, destroying property and endangering life, the maximum fine is $500 and the imprisonment ten years. Any person who shall either kindle a fire dangerously near the forest or prairie lands and leave it unquenched, or who shall use other than incombustible wads for fire arms or who shall carry a naked torch or exposed light in or dangerously near forest land, or who shall willfully or heedlessly deface or remove any warning placard posted as required by the act, is liable either to a fine not exceeding a hundred dollars or to three months' imprisonment.

The railroad companies are required to use efficient spark arresters on all their engines and to keep their right of way, for fifty feet each side of the center, clear of all combustible material, between the fifteenth day of April and the first day of December. Deposits of fire, live coals or hot ashes are forbidden in the immediate vicinity of woodlands, and trainmen are required to report fires discovered along the line at the next telegraph station they may pass. The railroad companies are required to instruct their employees in the means for preventing and extinguishing fires and to post the warning placards furnished by the forest commissioner in their stations in the vicinity of forest and prairie grass lands. "Where a fire occurs along the line of their road they shall concentrate such help and adopt such measures as shall be available to effectively extinguish it."

The railroad company violating the requirements of the act is punished by a fine not exceeding a hundred dollars for each offense, the railroad employee violating the law is deemed guilty of a misdemeanor and is punished by a fine of not less than five dollars nor more than fifty.

It is made the duty of every owner of a threshing or portable steam engine to use efficient spark arresters and to put out or cover with three inches of earth any live coals or ashes which they shall deposit in any place from the engine.

The Forest Commissioner is required to make a written report to the Governor of his proceedings under this act annually, which report shall include such statistics and facts as he has obtained from the chief fire warden and other sources, with suggestions for the preservation of forests and the prevention and extinguishment of forest and prairie fires.

In the legislative session of 1897, in Minnesota, an important bill was introduced, passing the house but failing in the senate. Its purpose was to encourage the growing and preservation of forests and forest reserve areas. Among the novel features of the bill was a section providing that any person or corporation being the owner of any tract of land partly cut over or entirely so, which, however, would not probably be utilized for agricultural purposes for many years, might deed the same to the State of Minnesota, if in the judgment of the State Forestry Board the land should be received for forestry purposes. Lands deemed necessary for the preservation of water courses are specially mentioned in the act as tracts to be thus accepted. Provision was made for the distribution of the revenues accruing from such land, two-thirds to be paid to such public educational institution as the grantor in the deed might designate.

The Wisconsin law is similar in general character to the Minnesota law, except that the chief clerk of the State Land Office and his deputy are made State Forest Warden and Deputy Forest Warden, respectively, without additional salary.

The Maine laws make the State Land Agent the Forest Commissioner. The selectmen of towns are made fire wardens. Anyone who neglects to extinguish a camp fire is liable to a fine not exceeding $100, or imprisonment in the county jail one month, or both. Railroad companies are required to burn or cut and remove all grass and debris from the right of way once a year, to use spark arresters on their locomotives, to refrain from depositing live coals, fire or ashes on their track, and to report fires along the right of way at their next telegraph station.

The Forest Commissioner encourages interest in forestry in the public schools and publishes circulars of information as to the care of woodlands.

Pennsylvania has a law, passed in 1895, and approved by the Governor, March 13, of that year, creating a Department of Agriculture, and charging it with the duty of caring for the forestry interests of the State. Section 3, of the law reads as follows:

Sec. 3. "That it shall be the duty of the Secretary to obtain and publish information respecting the extent and condition of the forest lands in this State, to make and carry out rules and regulations for the enforcement of all laws designed to protect forests from fires, and from all illegal depredations and destruction, and report the same annually to the Governor, and as far as practicable, to give information and advice respecting the best methods of preserving woodland and starting new plantations. He shall also, as far as practicable, procure statistics of the amount of timber cut during each year, the purposes for which it is used and the amount of timber land thus cleared as compared with the amount of land newly brought under timber cultivation, and shall in general adopt all such measures as, in his judgment, may be desirable and effctive, for the preservation and increase of the timber lands, and shall have direct charge and control of the management of the forest lands belonging to the commonwealth, subject to the provisions of the law relative thereto."

The legislature of 1897 passed several additional acts, making the constables of townships ex officio fire wardens and authorizing them without a warrant to arrest persons reasonably suspected by them of offending against the laws protecting timber lands. The owner of any land in that state having on it forest or timber trees, not less than fifty trees to the acre, measuring at least eight inches in diameter six feet above the ground, with no portion of the land clear, shall receive a rebate of 80 per cent of the taxes assessed and paid upon such land as long as the trees are maintained in sound condition. Such rebate shall not exceed forty-five cents per acre.

It is made the duty of the Commissioner of Forestry to examine the location and character of lands advertised for sale for non-payment of taxes, and if he finds them so located and of such a character as to make them desirable for the purpose of a forestry reservation, he may purchase them at the tax sales, subject of course, to right of redemption, to become part of a forestry reservation system, having in view the preservation of the water supply at the sources of the rivers of the state and the protection of the people of the commonwealth and their property from destructive floods.

By the same legislature a commission was created to be composed of the Commissioner of Forestry, the Chairman of the State Board of Health, the Deputy Secretary of Internal Affairs, a lawyer or conveyancer of ten years' professional experience, and a practical surveyor. The duty of this commission is to locate and report to the legislature three forestry reservations selected from lands suited to the growth of trees rather than to mining or agriculture, and with an average altitude of not less than six hundred feet above the sea level. Each of these reservations is to consist of not less than forty thousand acres. One reservation is to be located upon the head waters of the Delaware river, another upon the head waters of the Susquehanna and the third upon those of the Ohio.

Upon several points the legislation, in the states adjacent to Michigan, seems to be in substantial accord. In each of them a state forest park of broad area has been reserved and is to be maintained. These forest tracts subserve several purposes. They are the laboratories in which experiments aimed at the solution of forestry problems are tried; they are the equipment for forestry instruction to the people of the State who, unfortunately, are grossly ignorant of the fundamental principles of the sciences relating to the tree growing; they are broad enough to conserve the moisture at the head waters of the rivers and allow it to percolate slowly through the soil, keeping up the flow of the rivers during periods of drought, and finally each is the nucleus about which shall spread larger forests, owned either by the State or by private individuals.

In the second place, the enforcement of laws against forest fires and for the protection of forests generally is placed in the hands of a trained and well organized department. The chief officer is either elected or appointed solely as a commissioner of forestry, devoting his whole time to the work, or the duties of some existing State official are enlarged to include the enforcement of the law, and a sufficient number of trained assistants are provided. It is evident that until the public conscience is awakened to the enormity of the crime of starting forest fires and the public intelligence is aroused to comprehend the financial losses which they entail, it is impossible to so far enforce the best laws as to control or prevent devastating conflagration. The efficacy of legislation depends largely upon supporting public opinion. It is made the duty of the forest commissioner, therefore, to educate public opinion through the public schools and by means of special circulars and reports.

STRAWBERRY CULTURE.

BY L. R. TAFT AND H. P. GLADDEN.

Bulletin 163--Horticultural Department.

Letters are frequently received asking for information regarding the planting and care of strawberries, and believing that it will be of interest to many readers of the Bulletins, the following brief notes upon strawberry culture have been prepared.

For two or three years the price of these, as well as of other small fruits, has ruled quite low, but in cases where the berries were well grown, of large size and nicely packed, remunerative prices could usually be secured, while the poor or ordinary grades, in many cases hardly paid the cost of putting on the market.

Many growers are in the habit of setting the plants and giving fair care the first season, but the plants are allowed to layer so as to form a solid row of plants two or more feet wide. The result is that the plants are weak and the food and moisture furnished are insufficient to develop the large number of berries that are set. Although it is not generally practiced, many growers are in the habit of allowing the beds to fruit for six or eight years, and, as they become grown up to grass and weeds, poor fruit only can be expected.

While the hill system of culture cannot be generally recommended for all growers or for all varieties, under proper conditions the results obtained will be highly satisfactory, as the fruit will be of large size and will be produced in large quantities, but, the amount that will be obtained by the average grower from narrow matted rows will be larger from the same area than can be secured from hill culture.

We do not advocate commercial cultivation of strawberries except by those whose location is adapted to it, and who have the necessary information as to the best methods of handling the crops and the executive ability to grow and market them, but there are few persons who cannot have an area devoted to this crop, sufficient to supply fruit for their own table, and it is for such persons that the information here presented is particularly intended.

THE SOIL AND ITS PREPARATION.

Whether or not it is for a market or home patch, the results secured will, in a general way, be measured by the adaptation of the soil. As the strawberry contains a large amount of water and ripens at a time when a drought may be expected, the location selected should, so far as possible, provide a soil that is at least fairly retentive of moisture. Equal care should be taken that it is so thoroughly drained, either naturally or artificially, that water will at no time stand upon the surface and that in a very short time after a rain, the level of the standing water will be at least two feet below the surface. It is commonly said that any good corn soil will answer for strawberries, but, while this is true, on account of the much greater value of the crop, more care should be taken that it is in a proper physical condition and supplied with the needed amount of plant food.

As a rule, the lighter sandy loams should be avoided, as the crop will be likely to suffer from lack of water, while the stiff clays can seldom be properly worked in the spring, and if neglected are likely to bake so that the plants suffer more from the lack of water than upon the lighter sands.

In a general way, then, it will be seen that the heavier sandy loams and the lighter clay loams are best adapted for this crop, although good results will be obtained upon the lighter soils, if moisture can be provided. Fair returns are often obtained upon a soil of a mucky nature, as the water is generally so near the surface that droughts will have no effect, but two difficulties are frequently met with upon this class of soils, the first being the danger of frosts while the plants are in blossom, and the other that the plants make a rank growth and fail to form the necessary fruit buds. Where the mucky soil is in a basin, entirely or nearly surrounded by higher land, the blossoms seldom escape the frost, but if so situated that the cold air can drain off upon a lake, or still lower land, the danger will be lessened. After the land has been cropped for a number of years, the danger of the rank growth of plants will be greatly reduced, and if they are kept in hills, especially if a liberal amount of ground bone and ashes are used, a good crop of fruit can generally be expected upon this kind of soil, and, as there will be but little danger from drought, the fruit will be large and will bring the highest price.

In the home garden it is frequently impossible to find soil adapted to the growing of small fruits, and it will often pay, to go to considerable expense in improving the physical condition of the soil. Where the soil is of a heavy nature, it will often be possible to spread over the surface and mix with it an inch or more of sand or sandy loam; good results will also be secured by the use of fine coal ashes, either from hard or soft coal, and a liberal dressing of partially decomposed stable manure will also aid in loosening and lightening the soil. If the soil is of too light a nature and it is not possible to add clay or heavy loam, the use of muck or wood ashes will have a beneficial effect, the former supplying humus and the latter tending to render the soil more compact. A soil improved in this way will be in good condition for other crops.

To precede the strawberries, a heavy clover sod is desirable, as this can be turned under and will not only provide a large amount of plant food, but it will so add to the humus in the soil that there will be far less danger from drought. Cow-peas will in most parts of the State make a fair growth, and where the ground is not needed for other crops can be grown and turned under previous to planting the strawberries.

Sod land is not desirable, as it is generally deficient in humus and plant food and frequently contains insect larvae, which may prove destructive to the plants. Almost any of the hoed crops may be usd for one year previous to setting the plants and will leave the land in good condition for the strawberries, especially if it was heavily top-dressed with stable manure in the spring, or fall, previous to planting. Few soils will give the best results without the use of manure or fertilizer of some kind, and if the manure can be applied to the land at least one year before it is to be used for the strawberries it will decompose and will be in a suitable condition to yield up this plant food.

An application of fifteen to twenty loads of partially decomposed manure will be sufficient for most soils, but where wood ashes can be readily secured their use will be found profitable; fifty to one hundred bushels to the acre should be applied, after the land has been plowed, and worked into the soil when dragging.

For commercial plantations it will hardly be desirable to use chemical fertilizers, as, with clover and other green crops and the addition of manure and wood ashes, fertilizers will add but slightly to the yield, and the expense will not be returned in the crops; for the private garden, however, if the manure cannot be readily obtained, fertilizers may be used. A number of brands of fertilizers have been prepared by the different manufacturers, especially for the small fruits, and a thousand to fifteen hundred pounds per acre will give good results. For those who desire to prepare their own mixtures, however, we recommend one hundred pounds of nitrate of soda, eight hundred pounds of ground bone, and one hundred bushels of wood ashes, or, if these cannot be obtained, four hundred pounds of potash salts, either muriate or sulphate.

Although fall planting will give fair results under intensive culture, the best returns will ordinarily be secured from spring-set plants.

Unless the land is unusually heavy so that there will be danger of its puddling during the winter, it will be well to plow the land in the fall, and in the spring thoroughly pulverize the surface. With deep soil the furrows may be turned to the depth of seven or eight inches, but in a thin light soil, it will not be advisable to plow more than one-half inch deeper than the previous plowing. If the plowing was not done in the fall, it should be done in the spring as early as the ground can be worked and rolled to press the loose soils firmly down upon the under soil, in order that the upward movement of the water may not be checked. The dragging can hardly be too thorough, and especially if for any reason the plants cannot be set as soon as the land has been prepared, the working should be kept up, at least once a week.

In dragging the ground the disk or cutaway harrow may be used upon heavy ground, but ordinarily the Acme or springtooth harrow followed by a smoothing harrow or weeder will give good results. If the soil is at all cloddy, good results will be obtained with the use of clod crusher or roller.

In this way many of the small weeds which may start will be destroyed, and the labor of hoeing and cultivating during the season will be greatly lessened. The aid from this is so great that many growers purposely delay the putting out of the plants for several weeks on this account only. In the small gardens it will be advisable to have the strawberry plats so arranged as to allow the use of the plow, as it will do better work than the spade as ordinarily handled, and in much less time. Where the area is sufficient to permit the use of a horse, the land should be marked off at the proper intervals; these will vary with the method selected for the handling of plants. When the matted row is used the distance should be 3½ to 4 feet, the latter distance being preferred by many growers; but when the hill system of planting is used, the rows may be as close as 2½ or 3 feet, while some growers who expect to work the ground both ways, mark the land in squares of 2 feet.

PLANTS AND PLANTING.

All strawberry growers are aware that it is only the plants formed by the runners that should be used for the new plantation; these have yellowish white roots, and can thus be distinguished from the older plants, which have a long stem at the lower end of which are black or brown roots (Fig. 1), many of which are dead or broken. If plants of good quality, which can be depended upon to give large crops, are desired, those selected for planting should have good crowns and well developed roots (Fig. 2). As a rule, only the first plants on the runners should be used. When the plants are allowed to layer freely a large number of weak sets (Fig. 3) are produced, and, although these will grow, they give a small yield and the practice, if persisted in, will result in the running out of the variety.

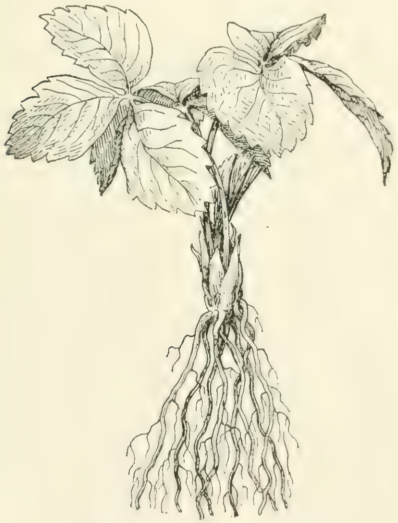


Fig. 2. Strong Young Plant.

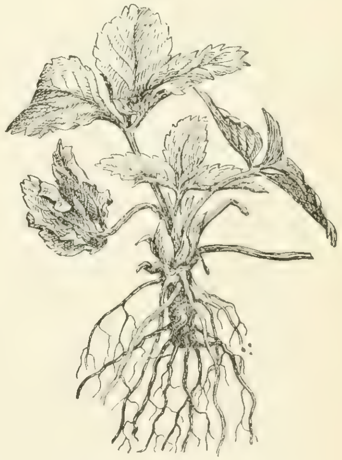


Fig. 1. Old Plant.

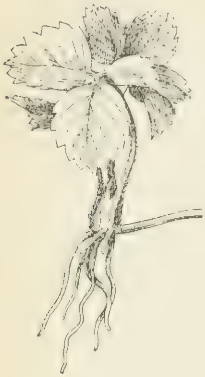


Fig. 3.
Weak Terminal Plant.

The best plants can be secured from fields that have been grown but one year, and which have not as yet fruited. The practice of obtaining plants from old plantations, although used by many persons, is not a good one, as continued fruiting cannot fail to sap the vitality of the plants and the runners produced by them will not give as good results as those from young plants. Whatever method of digging the plants is used, whether by spade, fork or potato hook, care should be taken that they are not exposed to the drying action of the sun or wind, and as soon as dug they should be placed in baskets, boxes or bags, and after being moistened should be put where they can be kept fresh and prevented from wilting.

Dealers in strawberry plants, when picking up the plants after they have been dug, generally remove the dead or diseased leaves and runners, and at the same time straighten out the roots and the remaining leaves. The plants are then tied in bundles or packed in baskets or boxes. Sometimes the operation of trimming and bunching the plants is not done in the field as it is found easier to do this in a packing shed, or other place, where the work can be done in the shade and the danger of the wilting of the plants lessened. Even though one is merely digging a few plants for home use, the removal of the leaves and runners and the straightening out of the roots should not be neglected. Sometimes the setting of the plants is necessarily delayed until late in the season, when, if the air happens to be dry, there will be great danger of the wilting and perhaps the killing of the plants from the heat and dryness of the soil and air. Under these conditions it will be advisable to cut off the leaves except one or two of the smaller ones, as by thus reducing their surface the evaporation will be lessened. When plants have been purchased and have become dry or heated in the bundles, it will be advisable to untie the bundles and either place them in water up to the crowns in some cool shady place, or to heel them in, so that the soil will be in contact with roots of each plant, in moist soil where they can be shaded and occasionally sprinkled. In a few days the plants that have not been killed will recover, and it will be possible to throw out those that have been spoiled. In this way the labor of planting will be lessened and there will be no vacant places in the rows from the use of injured plants.

While it will not be best to pursue this course when large areas are to be set, any one having a small plantation will find it advisable to put out the plants when the condition of the soil and atmosphere favor their growth. If they can be set just before a shower, or as soon as the ground is in suitable condition afterwards, their growth will generally be assured. Some go so far as to recommend the digging of the plants in the early morning, keeping them in a cool, moist cellar until late in the afternoon and then putting them out. Where this can be done there is undoubtedly a benefit from it, as the plants will contain much more moisture in the morning than when they have been exposed to the heat of the sun during the day, and by planting them in the early evening they will be less likely to wilt the following day than when the planting is done in the morning.

When the plants are being set, equal care should be taken that the roots are not exposed. If the soil has been so worked that a dust mulch has been provided, the soil that will be in contact with the roots will ordinarily have a sufficient amount of moisture, and watering will not be necessary, but, should the soil be dry, a pint or so of water should be given each plant before the planting has been completed; this will permit of the drawing of dry soil about it after the water has soaked in, and the baking of the soil about the plant, which otherwise might happen, will be prevented. In setting the plants a spade, dibble or trowel may be used, and if the work is properly done there will be little difference in the result secured. When the dibble or spade is used, a cut is made in the ground to the depth of 6 or 8 inches, and the soil is pressed back in either direction by a side movement of the handle; in the opening thus formed the roots are placed, care being taken that they are not cramped and that they are so spread out that the soil can be brought in contact with each of them. When large plants, with a thick mat of roots are used, this is particularly necessary, as otherwise the soil would only be in contact with a layer of roots upon the outside of this bundle and the inner roots will become dry and the plant will wilt. There is also considerable danger of loss if attention is not given to the depth at which the plants are set; they should be at such a depth that the bud will be just above the surface (Fig. 4 c), as if deeper than this there will be danger that, especially on heavy soil, the bud cannot make its way through the soil (Fig. 4 b), while if not deep enough (Fig. 4 a) a part of the roots will be exposed and the plant will be very likely to dry out. If placed, perhaps, a quarter or half inch deeper than it grows in the field, this will be sufficient to allow for the settling of the plant and will leave it in about the right position. In planting with the trowel the same method may be used as with the dibble or spade, but with a few plants many think it will pay to take somewhat more pains with the planting; a large hole is dug and in the bottom of this a conical elevation is left, around and upon which the roots are spread.

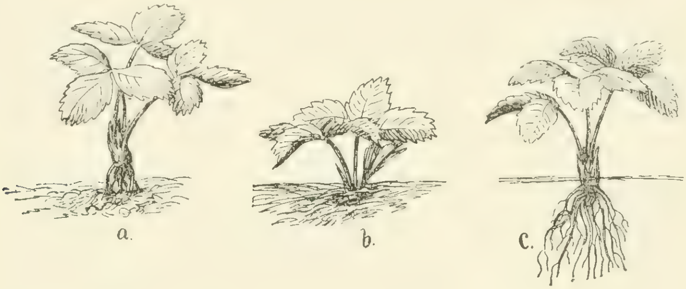


Fig. 4. DEPTHS FOR PLANTING; *a*, too shallow; *b*, too deep; *c*, just right.

After placing the plants at the right depth, the soil is pressed against them with the dibble, or hands, so that it will be in close contact with the roots, and the success of the planting will be increased if the feet are used to assist in packing the soil; pressure upon one side will generally suffice, but if the soil is sandy a foot may be placed at either side of the plant. The continued and repeated pressure with the feet about the plant, as practiced by some, is not advisable.

When the mound system of planting is used, the soil is drawn into the hole with the trowel and is firmed about the plant with the hands and feet. Some persons object to the use of the dibble in planting strawberries, and their objections can be well-sustained against the ordinary round dibble, or pointed stick, but the form used by most planters consists of a flat piece of steel or wood, 3 or 4 inches wide and nearly a foot long, which is pointed and with thin edges and provided with a D-shaped handle; with this a broad opening, something like that formed with a spade can be made and into this the roots can be spread. A man accustomed to the use of this tool will set nearly as many plants in well prepared soil, as two men when spades are used.

The distance between plants will depend somewhat upon the variety and also upon the method of cultivation. For the matted-row system, with varieties that are common, and that do not make many runners, the distance may be from 12 to 18 inches, but with new and choice varieties and such kinds as layer freely, intervals may be increased to two or even three feet. In hills, however, some growers, as mentioned above, set the plants two feet each way, while others have the rows three feet apart and the plants 12 to 15 inches apart in the rows.

Where the plants are in a small garden in which the cultivation is by hand, many prefer to grow the plants in beds. The plants are set about one foot each way and are kept in hills; four or five rows are grown and then a space of two or two and one-half feet is left for a walk, beyond which other beds are planted in a similar manner. With rich, moist soil this method gives excellent results in a small garden.

THE FALL PLANTING OF STRAWBERRIES.

Although not to be generally recommended, the fall planting of strawberries can sometimes be used with good results, but in order to succeed, special pains must be taken both with the soil and plants. In the states farther south, where the seasons of growth will be considerably longer, this method of growing strawberries is preferred to planting in the spring. In seasons when the weather is moist during

August and September, very good results can be obtained in Michigan, but if drought prevails there is danger of a check to the plants, and this will result disastrously. Upon soil that will not suffer seriously from drought, or where water can be applied, the fall setting will give good results. As the season of growth will be comparatively short at best, the soil should be thoroughly prepared and enriched. In order to promote a rapid growth the use of a small amount of some soluble fertilizer rich in nitrogen will be advisable. The plants should be of some strong growing variety that will furnish large crowns and that are adapted to hill culture, and only the strongest and best should be selected. It will be advisable to use either pot plants, or to take the best runners that form, and set them close together in some spot where they can be shaded and watered. If placed about four inches apart each way they will develop strong roots, and when the ground has been property prepared, they can be transplanted with but little check to their growth. The soil in which they are started should be of such a nature that they can be taken up with a ball of earth upon their roots. Unless water for irrigation is at hand, the planting should be delayed until the ground has been well moistened by rain, but if possible the planting should be done before the first of September. Good results, however, can be secured if the plants are set out by the middle of September. The rows should be from 2 to 2½ feet apart and the plants ten inches in the rows. Even though the ground has been well enriched, it will be advisable to mulch the plants by spreading decomposed manure along each side of the rows. Under these conditions a good growth will be secured and the plants will make strong crowns before winter. The ground should be occasionally worked during the fall and up to the time of freezing weather, so that it will be entirely free from weeds. The ground should then be mulched, and in the spring receive a shallow cultivation. It will be desirable to replace the mulch before the blossoms have opened, and unless the winter mulch is sufficient to cover the ground so as to keep down the weeds and conserve the moisture, an additional amount should be employed.

This method of strawberry culture is not recommended for the general planter, but for the amateur and for the home garden, especially where the starting of a new plantation was neglected in the spring, it certainly is worthy of trial. However, as stated in the beginning, good results should not be expected, except under the most intensive cultivation and where the growth of the plants is not allowed to be checked. As the plants are grown in hills, the fruit will be of large size, and where an increased price can be obtained for fine fruit, the results will be satisfactory for market purposes.

VARIETIES.

In selecting kinds for home use it is always desirable to include a sufficient number to provide a succession throughout the season, and there will be less occasion to consider firmness among the qualities to be desired than when they are grown for market purposes, but even more attention should be given to the flavor. While the hardiness and productiveness of the plants will always be the most important consideration, this characteristic even may be slightly sacrificed to produce varieties of high quality; regularity of form and a pleasing color will be desirable whether the varieties are for home use or market, and while the size should at least be medium, for home use, varieties that grow a large or very large sized berry will bring the most money for market varieties. As a rule, the very large sorts are less regular in form and of inferior quality to the varieties that are medium sized.

The accompanying report upon the varieties grown by this department last season gives lists that have been thoroughly tested in various parts of the State, and will be found generally adapted to the purpose for which they are recommended. Each year a large number of varieties are introduced which may have shown valuable characteristics upon the grounds of the originators, but comparatively few seem to be adapted to general cultivation, and for this reason we do not recommend the extensive planting of new kinds.

A few years ago the very early varieties generally brought a good price and it was found profitable to place these kinds upon a warm soil in order to hasten the maturity, but in recent years the southern berries have been brought in so freely that the price is little, if any, higher than can be obtained later in the season, and as the extremely early sorts are less productive than later kinds, their use in market plantations has for the most part been given up, except in sections where the southern berries have not found their way. Especially in the middle and northern part of the State the planting of late kinds has been found quite profitable, as they could not only be shipped to the south where they would bring a good price, as there will be no local competition, but shipments to points in Northern Michigan and in Minnesota also brought good returns.

By the proper selection of soil and location a considerable range of season can be secured, as early kinds upon a light soil and southern exposure will be hastened in ripening, while late sorts upon a heavy soil with a northern slope will be somewhat retarded and a season covering four or five weeks can sometimes be secured in this way.

PERFECT AND IMPERFECT FLOWERED VARIETIES.

The flowers of many varieties of strawberries possess no stamens, and, if these kinds are planted by themselves, the fruit produced will be small, irregular and of no value; these varieties are commonly spoken of as pistillate, or imperfect flowered (Fig. 5). There are also a large number of varieties that in addition to the pistils, have more or less small stamens, but, as the amount of pollen they produce is small, it will be best to depend upon perfect-flowered kinds (Fig. 6) to fertilize them. In some seasons they may develop all that will be required, but in others some varieties may produce an amount so small that it will not suffice to fertilize the pistils. Aside from the fact that varying amounts of pollen are produced by different varieties and that in the same variety it changes from year to year, it also happens that the amount required for the proper fertilization of the ovules varies in different years, as when the weather is warm and pleasant a much smaller quantity will suffice than when it is cold and wet. Still other varieties have a considerable number of strong stamens that produce large amounts of pollen, and if the pistillate, or nearly pistillate kinds are grown, it will be advisable to have at least every fifth row of these strong staminate kinds that flower at the same time. Some growers living in sections near the lakes where the air is moist, and where fogs prevail, find that in order to secure perfect fertilization of pistillate varieties, it is well to have every third row of some variety that produces a large amount of pollen.

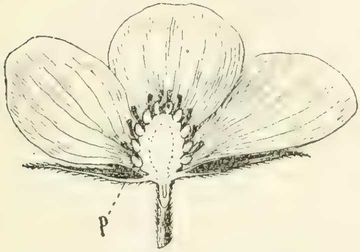


Fig. 5. IMPERFECT STRAWBERRY BLOSSOM; *p*, pistils.

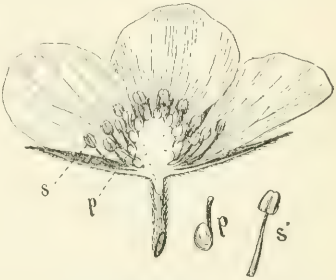


Fig. 6. PERFECT STRAWBERRY BLOSSOM: *p*, pistils; *s*, stamens; *p* and *s* do, magnified.

While it does not hold true in all cases, careful examination of the list of productive varieties of strawberries will show that imperfect-flowered kinds are as a rule rather more productive than those with perfect flowers, which has been ascribed to the fact that the staminate kinds have exhausted themselves, in part at least, in the production of the pollen, and are consequently able to develop but a comparatively small amount of fruit. However, as the rule does not hold true in all cases, the merits of the individual varieties should be considered in making the selection.

CULTIVATION AND CARE.

Unless rains fall immediately after the plants are set, the cultivator should be started, and from this time until the middle of August, the land should be worked at least once a week whenever it is in a suitable condition; if the season is dry two or three times a week would not be too much. Especially if the soil is heavy and the season moist the cultivation during the spring may be comparatively deep, but within a very few weeks the roots will have so extended themselves that they will occupy the entire space between the rows, and if the deep cultivation is continued, the roots will be injured and the growth of the plants checked. Ordinarily if the ground is worked to the depth of 1½ or 2 inches after the first month, the best results will be secured, as it will be amply deep to destroy the weeds and conserve moisture, and it will not injure the roots. While cultivators with somewhat wider shovels may be used during the spring, after the weather becomes dry those with spike or, at least, very narrow teeth, should be used. Some have recommended the use of weeders for cultivating strawberries, but while they get over the ground quickly and leave it in an excellent condition, they loosen many of the plants, even though they do not break them off, and it is not advisable to run them over rows. However, when the land has been carefully marked and the plants set in straight rows, weeders can often be used with good results, by first removing such of the teeth as would touch the plants, and when weeders are made with removable wings they can be so narrowed down that they will work between the rows, and then form an excellent substitute for cultivators.

The ideal method of cultivating strawberries is to have the land at all times in about the condition it would be if worked with a garden rake, and this can only be secured when tools with narrow teeth are used. If the soil is inclined to bake, it will often be advisable to break the crust that forms about the plants after a rain, and during the season it should not be neglected whenever necessary to keep down the weeds and prevent the formation of a crust. As a substitute for the hoe, a light potato hook is recommended, as this can be used to work closely about the plants without danger of injuring them, and will leave the surface in better condition than the hoe.

During the first season the plants should not be allowed to bear fruit, and as soon as the blossom stalks are large enough to permit of its being done readily, they should be broken or cut out. Where the plants start to form layers in large numbers, early in the season, it will be advisable to remove them. This may be done with a hoe, or with some of the cutters made for the purpose. The rolling cutters that are attached to a cultivator frame will remove some of the runners, but do not do it thoroughly, and their use is seldom satisfactory.

After the middle of July plants that are to be grown in matted rows are allowed to layer, and ordinarily no attention is paid to assisting them, but if the season is very dry, and few runners are formed they may be layered by hand. Some growers also find it advisable to layer the plants by hand, and thus distribute them so that the ground will be occupied to the best advantage. When the plants are two feet apart, two runners are layered at either side of each original plant, so that they will form a square with the old plant in the center. The other runners are removed and the plants are allowed to thicken up and give nearly as good results as can be obtained from hill culture.

The growers who plant so as to work the ground both ways, and still wish to grow the plants in matted rows, are only able to keep up this practice until about the middle of July, and after that work the land in one direction only. In this way the runners are distributed lengthwise of the rows, where they soon become layered. It will generally be best to restrict the width of the row to eight or ten inches.

The care of plants to be grown in hills will be much the same except that throughout the season all runners are cut off as soon as they appear, and as a result a number of crowns will be formed by each plant and the plants will so thicken up that they will occupy a space a foot or more in diameter.

MULCHING.

Especially upon land where the plants are likely to be heaved by its freezing and thawing during the winter, the use of a mulch will be advisable, and for the hill plants it should seldom be dispensed with upon any soil. On light soils there will be comparatively little injury to plants grown in matted rows, and the use of a mulch as a winter protection will not be necessary, although if material can be readily secured, its use even then will be advisable. It will generally be best to defer the spreading of the mulch until the ground is frozen. The materials used may be such as can be readily secured and that are free from the seeds of grass, weeds, etc. If it can be obtained, a mulch of marsh hay will be desirable, but straw answers very well. Where forest leaves can be easily secured they may be used between the rows of plants, but are not advisable upon them, as they pack down too closely. If they are used, a thin covering of straw will be necessary to hold them in place and to cover the plants. Where the land has not been properly enriched, some think it advisable to put on a liberal dressing of stable manure, which will also answer as a mulch. This should be thoroughly decomposed, as otherwise there will be trouble from the growth of seeds of grass and clover. Corn stalks also make a clean mulch, but are rather unsightly. The amount of mulch that should be used, should depend somewhat upon the method of handling the plantation the following summer. If the ground is not to be cultivated before the crop is gathered, the covering should be thicker than when cultivation is to be given. When the mulching material is abundant, it may be used to the depth of three or four inches, except over the plants, where it should be only thick enough to merely cover them. A mulch of this thickness will not only prevent winter injury, but it will serve to keep the weeds down during the summer, as well as to hold the moisture. If the land is to be worked in the spring, a depth of two inches or barely enough to prevent injury from freezing will be sufficient. Some growers who are able to secure a good price for their fruit late in the season use an extra thickness of mulch in order to delay the fruiting period. By planting upon a hillside sloping to the north, and by leaving the plants covered as late in the spring as possible, considerable difference may be secured. However, care must be taken not to leave the mulch over the plants too late, as they start into growth under the mulch, and the blanched tender shoots are easily injured, either by frost or by the sun, when uncovered. It is often recommended to apply a heavy mulch and leave it on in the spring to defer the starting of the plants, and thus render them less likely to be injured by the frost, but except upon a north slope there is great danger of the late and thick covering doing more harm than good.

Ordinarily it will be found desirable to remove the mulch directly over the plants as soon as growth has started. If the ground is not to be cultivated this may be placed between the rows and allowed to remain undisturbed until the crop has been gathered. Oftentimes if just the right thickness of mulch has been used over the plants, it need not be disturbed at all, as the plants will find their way through it, and the mulch will both aid in keeping the weeds down and prevent the baking of the soil among the plants. If the field was kept free from weeds the first season, they should give little trouble previous to the ripening of the fruit, but if any large weeds appear, they should be pulled or cut out.

Where a mulch is not used, and especially if the land has not been properly treated the first year, it sometimes becomes necessary to work the ground in the spring in order to keep it free from weeds. If this becomes necessary, the cultivation should be given as early as possible, and should not be kept up after the plants are in blossom. Where the hill plants have not been mulched there will be even greater necessity for spring cultivation. Some growers dispense entirely with the mulch, but even though it is not used in the fall, the best fruit will only be secured when the plants are mulched, and if they are not mulched in the winter, it should be applied in the spring before the fruit has set. It will not only keep the berries clean, but it will be of great value in conserving moisture if the season is dry. Many growers who mulch in the fall find it advisable to cultivate their plants, however, in the spring and to do this the mulch must be taken off and again replaced after the cultivation has been given. By throwing the mulch from four or five rows together it can be done with but little labor.

PREVENTING INJURY FROM FROST.

Although Jack Frost is continually showing freaks, the injury that is done to the blossoms can be greatly lessened if proper care is taken to secure a location with thorough air drainage which can be best obtained on an elevated rolling site. While this is quite essential in the interior of the State, less attention need be paid to it near the lake shores and along rivers. When the air is well charged with vapor the injury from frost is greatly reduced, and where water is available, a crop can often be saved which would otherwise be destroyed, by sprinkling the plants just at night, or, better yet, very early in the morning, when the temperature drops to 32 degrees. With a supply of hose and an ordinary lawn sprinkler a considerable area can be covered. When the plants have been mulched during the winter, this material may be placed over the plants when a frost is expected, and if the temperature does not drop too low, the blossoms can thus be saved, but if the frosts continue for a number of days there is a probability, that unless the covering is removed during the day, the plants will be softened, and when the covering is finally taken off the danger of injury will be increased.

While many attempt to delay the blooming of the varieties in order that the danger of frosts might be lessened, by leaving on the winter covering late in the spring, a few have gone even farther and have covered the plants with a thick layer of ice, a covering of straw being placed over this to delay the melting of the ice, and as a result the blooming, as well as the ripening period, will be somewhat later.

Where one has large areas and water for irrigating or sprinkling is not at hand, a smudge of some kind may be used that will make a thick smoke. This will settle over the beds and prevent the radiation of heat, and lessen the danger from frost. Upon still nights, when the danger of frost is the greatest, the most marked results can be secured. While various materials have been burned to produce the smudge, the best results have been obtained from piles of straw over which coal tar has been poured. While they should be closer together on small areas, the distance between the piles need not be less than 75 or 100 feet for a field of a number of acres. If the materials are prepared and distributed when frosts are to be expected, it will be a simple matter to fire them about two o'clock in the morning. If at that time a thermometer near the ground in the field shows a temperature of 37 degrees, or less, and if the conditions seem to favor its dropping still lower, it will be advisable to fire them.

IRRIGATION.

There are few locations where strawberries are not each year more or less injured by lack of moisture in the soil, and where water can be readily secured for irrigating purposes, the expenses of applying it will be well repaid. Oftentimes a single application made when the fruit is about one-half grown will double the yield, and occasionally a crop will be saved, which would otherwise be lost. Although its use is of less value during the first season's growth, it will often be found desirable when the weather is dry, to make an application in order to promote the growth of the plants. Some growers have received good returns where water has been pumped by windmills, steam or gasoline engines, but few would care to go to that expense. However, there are some locations where water can be taken from a stream and turned upon the land, and there will be no question but what irrigating can be made to pay. The water should be carried in furrows between the rows, and applied in sufficient quantities to cover the surface to a depth of one inch, which will require about eight hundred barrels per acre. It is in the home garden, however, where irrigation can be used to the best advantage in Michigan; as the water supply for the house or barn can generally be used for irrigating. If sufficient pressure can be secured, it will be best to make use of lawn sprinklers, which can be moved over the beds so as to thoroughly wet down the soil. If the land is thoroughly mulched a single watering will last for several days, and perhaps will be all that will be required. If the needed pressure cannot be secured, and particularly if the water supply is limited, it will be advisable to make use of subirrigation. By placing a line of drain tile below the surface, a strip from ten to twenty feet can be watered. If to be left permanently the line should at least be below the reach of the plow, and in case the land requires under-draining, the tile may be so arranged as to answer for both purposes. The depth should then be not less than 2½ feet, and the tile should be laid as nearly level as possible, and yet give a fall towards the outlet. When required for irrigating, the lower end of the tile can be closed and the drains flooded from the highest point. If merely needed for the strawberry crop, a temporary system of tiles may be laid. If put in before the plants are set, they should be covered at least four or five inches to be below the reach of the cultivator, but oftentimes the necessity is not recognized until about the time the fruit is ripening, and then it will be sufficient if the tiles are barely covered. Care should be taken to have the lines of tile practically level for lengths of less than one hundred feet, and beyond this the slope should be very slight. Where the tiles have a greater slope the water rushes to the lower end and breaks through to the surface. When properly arranged the water should enter the tile only as fast as it soaks through the joints. In this way the tiles will be kept full and the water will be very equally distributed throughout the length of the tile. While smaller or larger sizes might be used, a three-inch common drain tile will give the best results. As most tiles are slightly curved in burning, by placing them with their rounded sides uppermost, a small crack will be left on the under side of each joint, and if care is taken that these openings are of about the same size, the water will be very evenly distributed. When the plants are set in narrow beds, a single line of tile along the center will suffice, but the best results will be secured if the water is not required to spread more than six or eight feet each way, although upon some soil a much wider distribution can be obtained. Several lines of tile may be connected so that they can all be filled from one point, but ordinarily the best results will be secured if the lines are independent, and each is filled from the highest point. A very small stream of water through a garden hose will supply a line one to two hundred feet in length, and after having adjusted the flow, it will require no attention until the ground has been thoroughly wet down. As the water will be applied beneath the surface there will be much less loss from evaporation, than when furrows are used and consequently it will be more economical of water, and will permit the covering of a considerable area through a small supply pipe with but little attention. Under the same conditions the use of furrows would not give nearly as even distribution and would require constant attention.

CLEANING OUT THE OLD BEDS.

As a rule when the beds have been well cared for and are free from grass and weeds, it will be advisable to keep them for a second crop. Especially if the plants have been attacked by insects or fungi, good results will be obtained from burning over the beds. To do this it will be necessary to have a supply of dry material, but the mulch will generally provide a sufficient amount. In order that the old strawberry leaves may be burned, a mowing machine should be run over the beds a day or two before the burning is to be done, and if there is a large amount of mulch that has become packed closely together, it should be loosened with a hay tedder or fork, as otherwise it will burn so slowly that there will be danger of its injuring the crowns of the plants, and if the amount is very large a part of it should be removed. The amount that is required is the least that will suffice to induce the fire to run over the entire bed. While a high wind will not be necessary, or desirable, the burning should be done when there is at least a gentle breeze that will carry the flames over the bed. Upon a still day there is danger that it will burn so slowly as to injure the plants.

In cleaning out the weeds and surplus plants, the use of a plow will be advisable, if the space permits. Furrows should be run upon each side of the rows, throwing the soil away from the plants so as to leave strips four or five inches wide. By means of a hoe the plants should be cut away so as to leave one of the young plants for each foot of the row; grass and weeds should at the same time be cut out. If the land is not fertilized decomposed manure or commercial fertilizers may be scattered along the rows and the furrows worked down with a cultivator.

For the rest of the season, the care should be the same as for a young plantation, and by winter young plants will have formed so that it will have much the same appearance as a bed set in the spring. While some growers allow the beds to fruit for a third year, the results will as a rule, not be as satisfactory, as will be obtained from young plantations. On the other hand some varieties like Gandy do not get fairly established the first season, and the second and third crops will be larger than the first.

INSECTS AND DISEASES.

Ordinarily the strawberry is comparatively free from the attack of insects, and little attention need be given to them. When the plants are set upon recently plowed sod land, there is danger from white grubs and cut worms, but if, as is commonly practiced, strawberries are not placed upon land that has had sod upon it within less than two years, there will be little loss from this source.

Where cut worms are troublesome, they can generally be destroyed, if after fitting the land for the strawberries, freshly cut clover that has been soaked or sprayed with Paris green, or arsenic water is scattered in small bunches at intervals of six or eight feet each way.

For two or three years injury has been reported from the work of the strawberry leaf-roller in various parts of the State. The larvae of these insects draw the leaves about them and feed upon the foliage, causing it to turn brown and become dry. Late in June they enter the pupa state, from which they emerge as moths in about ten days and deposit eggs for a second brood. The second brood of the larvae attain maturity the last of September or the first of October, but do not appear as perfect insects until the following spring.

After the insects have drawn the leaves about themselves it is difficult to reach them with any application, but in sections where trouble is feared from these insects in new plantations, the plants should be thoroughly sprayed with Paris green or arsenic about the middle of June, and the applications should be repeated once in ten days up to the middle of July. The Paris green should be used at the rate of one pound in 150 gallons of water, and lime should be added to prevent injury to the foliage, and to hold the poison so that it will not be washed off by rains. If in spite of the spraying it is found that the insects have passed into the pupa form the leaves should be picked off if the numbers are not great, or a heavy roller may be passed over them. Although this will not destroy all of the insects, it will crush large numbers of them. About the first of September before the second brood is hatched, another application of the poison should be made, and followed by two or three more at intervals of ten days. Frequent repetition of the spraying is necessary, as new leaves are constantly appearing, and if they are not covered with the poison the insects which feed upon them will escape to start a new brood. It will not be safe to use the poison during the fruiting season of the second year, but as soon as the crop has been harvested steps should be taken to destroy the larvae, whether the plants are to be kept for a third year or not. This can be done by the thorough burning of the leaves as recommended above. Some persons have thought that if the plantations are not to be kept for another year it would suffice to plow up the bed, but this is not sufficient to destroy the larvae, and many of them would complete their development and come forth as moths to deposit their eggs upon neighboring plantations. In September when there is danger of a second brood, the plants should be sprayed as recommended for the first year.

The treatment above recommended is, of course, rather expensive, but in sections where the leaf roller has become as numerous as it is in various parts of Southern Michigan, something of the kind must be done if a crop is to be secured, and especially if the insects have not previously appeared in a section, but are found upon plants that have just been purchased, the danger of injury is so great that a considerable expense would be warranted in exterminating them. When plants are purchased they should be carefully examined, and if leaves that contain small larvae or chrysalides are found, they should be carefully picked off and burned, and the plants dipped into Paris green for a length of time sufficient to permit it to penetrate to all parts.

THE STRAWBERRY WEEVIL.

Although not generally common, a small insect known as the strawberry weevil has done considerable injury in some sections by feeding upon the pollen of perfect flowered varieties, thus not only preventing them from fruiting, but rendering the fruit of the imperfect-flowered kinds of no value. In sections where the weevil is at work the strawberries will need attention while in bud, or the crop will be a failure. M. Nelson of Menominee, Michigan, who has been considerably troubled with these insects, has invented a machine for the burning of sulphur and blowing the fumes upon the plants, and finds it a sure remedy. Of the ordinary remedies nothing will be found of more value than Paris green and lime water sprayed over the plants, but in order to have the treatment effectual, a second application at the end of three or four days will be advisable. The application of the water should be made before the buds open, as it will be of little use against the larvae. The perfect insect deposits its eggs inside of the flowers before they open, and, and then punctures and cuts the flower stems so that they drop to the ground. The flowers remain closed and the larvae developing inside feed upon the pollen. Care should be taken not to apply poisons after the fruit has set. While in some cases there is undoubtedly considerable benefit from the poison, it is likely that the lime sprayed over the plants acts as a deterrent, and has perhaps an even greater benefit than the poison. In the case of varieties that are injured by the leaf blight, Bordeaux mixture should be submitted for the lime, as it is a fungicide, and will both serve to destroy insects and prevent the spread of the disease.

THE STRAWBERRY LEAF BLIGHT.

While subject to the attack of but few diseases, nearly all varieties of strawberries are more or less injured by the fungous disease commonly known as strawberry rust or leaf blight. This attacks, not only the leaves, but the fruit stalks and the calyx, or husk, about the berries, and the injury is then so severe that the crop fails to ripen. It appears first as a purplish spot upon the leaves, but as this enlarges the center becomes brown, and finally white. If these spots are numerous upon the leaves, the tissue finally dries out and the entire leaf will be destroyed The injury is even more severe when upon the fruit stems, as a very small spot will be sufficient to girdle them, and the shrivelling and drying of the fruit will follow.

There is a marked difference in the susceptibility of the different varieties to attack by this disease, and in selecting varieties for planting those that are the least subject to attack should be chosen. Some of the kinds that when free from a disease are very productive become almost worthless when the conditions favor the development of the fungus. When grown under conditions that favor a normal growth, and when they are not subjected to a check, even the kinds that are most subject to injury frequently escape. Experiments have frequently shown that all varieties can be kept practically free from the attack of this disease if properly sprayed with Bordeaux mixture. In setting out a new plantation care should be taken to obtain plants that are practically free from disease, and all leaves that show signs of an attack should be removed and burned. As there may be spores of the disease upon the remaining leaves, it will be well to dip the plants into Bordeaux mixture, and after they have been set in the field, after a week or ten days, they should receive a spraying with the same material. One or two other applications at intervals of two weeks will also be advisable, and still another should be made about the first of August in case diseased leaves can be found at that time. The following spring the plants should be sprayed as soon as growth has started, and a second application should be made after the flower buds have formed, but before they open. As noted above, the use of Bordeaux mixture at this time will have a marked effect against the strawberry weevil, especially if Paris green is added. This treatment will ordinarily carry through the varieties that are most subject to the attack of leaf blight without serious injury. If the plantation is to be kept for another year, it will be well to burn it over, and to spray as soon as the new leaves have formed.

A BACTERIAL DISEASE OF THE STRAWBERRY.

Although it does not cause much trouble in Michigan, we have received a number of specimens of plant affected with some form of bacterial disease. These were from soils that had been enriched with nitrogenous fertilizers and contained a large amount of humus, and the diseased condition appeared after periods of warm, moist weather. The conditions under which the disease proves troublesome will point out the preventive remedies, but if the disease makes its appearance in a plantation, it will be well to at once remove and burn the affected plants. Care should be taken in putting out a new plantation to obtain healthy plants. Land in which the disease has appeared should not again be used for strawberries within several years.

NOTES ON VARIETIES.

For a number of years this department has issued bulletins, giving the results of its trials with a large number of strawberries. An attempt has been made to keep the collection as complete as possible by the addition each year of the new varieties that are placed upon the market. We have also attempted to secure all new and promising seedings from the originators before ever placed upon the market in order that the public might be informed as to their value. Comparatively few of the sorts thus obtained have been deemed worthy of general introduction, and after trying them two or three years they have been dropped from our lists. Such varieties as seem to have merits that will make them worthy of planting, either for home use or for market, have been retained and if especially worthy have been put out in numbers sufficient to afford a thorough test. In order that we might be still better informed as to the value of the varieties for planting in different parts of the State, we have each year selected a number of kinds that are highly recommended and that to us seem to have some merit, and have sent a dozen plants of each kind to fruit growers in different parts of the State. In selecting these an endeavor has been made to place the plants in the hands of parties who will give them at least ordinary good care, who will note the results and report upon the varieties after they have fruited. While many of the kinds thus sent out have shown no valuable characteristics, others have given excellent satisfaction and as a result of the distribution we have not only assured ourselves of the value of the varieties, but have distributed the plants. In the tests that have been made at the Station we have endeavored so far as possible to put the plants under about the same conditions that they would find when in the hands of ordinary growers. Our soil is but poorly adapted to fruit culture, and varieties that succeed here should do even better in commercial plantations. The land that we have used has been fairly well manured with stable manure. This has been applied broadcast in the fall and turned under. In the spring, after the land has been properly fitted, it has been marked into rows 3½ feet apart and the plants are set at intervals of eighteen inches. Twenty-four plants of each variety are used, as a rule, although when the new kinds are sent to us for trial the number received is frequently only twelve. In order to test the merits of the different kinds under hill and matted row culture, we have cut the runners from twelve of the plants and have allowed them to form narrow rows upon the others. The plants had ordinary good care during the season, were mulched in the fall and the weeds that appeared during the spring were cut out, without disturbing the mulch except to remove it from the plants.

Notes are taken of the dates of blossoming and ripening of the different varieties, as well as upon the vigor of the plants, their productiveness, and the size, shape, color and firmness of the fruit. In the following table these characteristics have been indicated. Instead of writing it out in full, abbreviations are used, the meaning of which is given at the head of the table. In the text that follows will be found descriptions, first, of the varieties that have been fruited but one season. This is followed by a description of the varieties that were fruited first in 1897, few of which have been commonly tested. At the end will be found descriptions of some of the older and better known kinds. In the summary of the varieties, short lists of some of the more promising new varieties and others that include the better of the old kinds are given.

STRAWBERRIES.

ABBREVIATIONS.

Form.
b. broad.
c. conical.
d. depressed.
i. irregular.
l. long.
o. oval.
r. round.

Size.
s. small.
m. medium.
l. large.

Sex.
p. pistillate or imperfect.
b. bisexual or perfect.

Color.
b. bright.
c. crimson.
d. dark.
l. light.
r. red.
s. scarlet.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness.	Size.	Form.	Color.	Quality.	Firmness.
Anna Kennedy	p	8.8	May 24	June 10	June 22	6.5	m l	r c	b s	9	9
Annie Laurie	b	9	" 24	" 5	" 21	6	m l	r c	b s	9.8	9.5
Apache	b	10	" 19	" 4	" 20	8.8	m	l c	l s	5	8
Arkansaw Traveler	b	6.5	" 24	" 6	" 23	8	l	r c	d c	8.8	8.5
Aroma	b	9.2	" 24	" 9	" 25	8.5	l	l c	l s	8	9.5
Arrow	p	8.8	" 22	" 4	" 23	8.5	m l	l c	l c	9.5	8.5
Avery	p	8	" 22	" 10	" 24	9.5	m	l c	b d s	9.5	7.5
Beder Wood	b	8 8	" 21	" 9	" 22	9	m	r	l c	8	8.5
Beebe	p	8.5	" 21	" 11	" 27	7.8	m l	r c	c	9	8.5
Belle	b	8	" 19	" 9	" 25	8	m l	l c	b s	8	9
Bird	p	7.2	" 20	" 9	" 26	7.5	l	l c	b d s	9	9.2
Bisel	b	7.5	" 21	" 10	" 23	7.5	m	b c	b c	9	9
Bismarck	b	8.8	" 22	" 9	" 25	9	l	r c	d c	8	8
Blonde	b	9.4	" 22	" 10	" 24	8.2	m	r c	l r	8	7.5
Bostonian	b	9.5	" 21	" 10	" 25	7.5	m l	r c	b s	9.8	9
Brandywine	b	9.7	" 21	" 9	" 25	9	l	r c	b d c	9.5	8.5
Bryant	b	9	" 20	" 10	" 26	9.5	l	b c	b d c	7	9.5
Bubach	p	9.4	" 21	" 9	" 25	8.8	l	d c	l c	9	8
Burnett	b	7	" 24	" 10	" 26	8	l	r c	b c	9.5	8.2
Canada Wilson	b	9	" 19	" 7	" 21	8	s	r c	v d c	8	9.5
Carrie	p	8.5	" 19	" 7	" 24	8.5	l	l c	d c	7.8	9.2
Cherokee	p	8.8	" 20	"	" 24	8	m	r c	c	9	8.5
Childs	b	8	" 22	" 7	" 22	7	l	d c	b c	9.5	9
Clyde	b	9.4	" 21	" 9	" 24	9	l	r c	l s	9	8.5
Cobden Queen	p	9.8	" 20	" 7	" 23	9.2	l	r d c	l s	7.8	7
Columbus	b	8.5	" 20	" 7	" 25	7	l	r c	b s	8.5	8.5
Crescent	p	9	" 20	" 7	" 22	9	m	r c	l s	8	8 5
Cyclone	b	8.8	" 20	" 3	" 22	5	m	l c	d c	9	9

STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe Fruits.	Last fruits.	Productiveness	Size.	Form.	Color.	Quality.	Firmness.
Dakota	b	9.2	May 19	June 6	June 25	9	s	l c	d s	9	7
Dictator	p	5	“ 21	“ 9	“ 24	4	m	r c	r	7.5	8.5
Dollar	b	9	“ 20	“ 9	“ 24	8.8	l	l c	b s	9.2	9
Earliest	b	9.2	“ 21	“ 2	“ 21	6.5	m	r c		7.5	7
Early Bird	b	8	“ 20	“ 8	“ 21	4	s	i	l c	7.5	8
Early Jack	b	9.8	“ 19	“ 6	“ 21	8.2	s m	i	d s	7	7
Edith	p	5	“ 23	“ 12	“ 26	5	m	l b c	d c	9	9.5
Enhance	b	9	“ 22	“ 11	“ 26	8	m	i r c	d s	9	9
Enormous	p	7.5	“ 22	“ 6	“ 21	7.5	l	i	d c	9	9
Epping	p	8.8	“ 22	“ 8	“ 23	9	l	r d c	l s	8	9
Equinox	b	8	“ 22	“ 6	“ 23	5	s	d c	c	8	8.5
Evans	b	9.5	“ 21	“ 8	“ 23	7.5	m l	r c		9	7.5
Fountain	b	9.7	“ 22	“ 7	“ 24	9 4	l	b c	v b c	9	9.2
Fremont	b	9.6	“ 21	“ 8	“ 26	9.5	m l	l c	b s	9	8.8
Gandy	b	9.2	“ 24	“ 12	“ 28	8.8	l	b c	l c	8.5	8 5
Gardner	b	8	“ 19	“ 9	“ 26	9.7	l	b c	b c	8	8 5
Gen. Fifer	b	9	“ 21	“ 10	“ 26	8 5	m	r c	b r	9	8
Gertrude	b	8.5	“ 21	“ 6	“ 23	4	s m	b c	l s	8	8.5
Giant	b	8.8	“ 19	“ 7	“ 22	9.5	l	r c	d c	9.8	9.5
Glen Mary	b	9.4	“ 21	“ 8	“ 24	9.5	l	c	b s	9	9
Graham	b	8.8	“ 20	“ 8	“ 22	9	m	r c	d c	9.2	8
Granville	b	8.5	“ 21	“ 10	“ 25	8	l	r d c	d c	9	8
Greenville	p	9.5	“ 22	“ 9	“ 26	9	l	r d c	b c	8.5	7.5
Hall Favorite	b	6	“ 24	“ 9	“ 25	8	m l	d c	d c	8.8	8.5
Hatch Exp. Station	b	7	“ 21	“ 9	“ 23	9	l	r c	d c	9.5	8.5
Haverland	p	9.5	“ 20	“ 8	“ 23	9	m	l c	s	8.5	8.5
Herbst	b	8.7	“ 22	“ 11	“ 26	8.5	m	l c	v d c	7.5	9.5
Hersey	b	8	“ 24	“ 7	“ 22	8.5	s	r c	v d c	9.5	8
Hilton Gem	b	9.8	“ 22	“ 8	“ 23	9.2	l	l c	b d s	9	8.8
Holland	p	9.5	“ 26	“ 8	“ 23	8	m	l b c	d c	9	9
Homestead	b	9.2	“ 22	“ 7	“ 21	9.2	s	i	r c	9.8	7
Hood River	b	8.5	“ 23	“ 8	“ 23	9	m	r c	b c	9.7	9
Hoosier	b	9.7	“ 20	“ 10	“ 24	9 8	l	l c	d c	9.5	9.5
Howell No. 2	b	8	“ 21	“ 10	“ 25	8 5	l	l c	b d c	9.5	9
Hull No. 3	b	8.5	“ 22	“ 7	“ 23	7	m	d c	l s	9	7
Ideal	b	9.6	“ 22	“ 8	“ 24	9.2	m l	r c	b c	9	9
Iowa Beauty	b	9.5	“ 20	“ 7	“ 25	8	m	r c	d c	9.5	8.5

STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1–10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness.	Size.	Form.	Color.	Quality.	Firmness.
Jarbalo	b	9.7	May 24	June 7	June 22	7.5	m l	r c	d c	7.5	8.5
Jerry Rusk	b	8	" 19	" 7	" 24	8	m	r c	b s	9	9
Kansas	b	9.2	" 20	" 7	" 21	9	m	r c	d c	9.5	8.5
Karl	b	10	" 21	" 7	" 24	6	s	i	d c	6	6
King Worthy	b	8.8	" 23	" 9	" 23	8	l	r c	d s	8	7.5
Knight	b	9.7	" 23	" 10	" 26	9.4	l	r c	b d s	9.5	9.2
Kossuth	b	9.3	" 20	" 7	" 24	8.8	m	r b c	d c	9.2	9
Kyle No. 1	b	9.6	" 24	" 9	" 25	7	m	r c	l s	6	6
Lana	b	9.3	" 24	" 9	" 21	9	m	c	l s	8.5	9.4
Laxton No. 1	b	8	" 21	" 7	" 22	7	s m	r c	d s	8.5	8
Leroy	p	9.4	" 19	" 7	" 22	9.4	l	d c	d c	9	9
Little No. 7	b	9.8	" 20	" 6	" 22	8.5	m	r c	d s	8.5	8.8
Little No. 8	b	8.8	" 22	" 9	" 24	7	m	b c	d c	9.5	9
Little No. 40	p	9.2	" 21	" 10	" 26	9.6	l	b c	b c	9	9
Lovett	b	8	" 23	" 7	" 23	7	m	r c	b c	8	9
Luther	b	7	" 20	" 3	" 19	7	m	r c	d c	8.5	8.8
Manwell	b	8.8	" 21	" 10	" 21	9.5	l	b c	d c	9.2	9
Marshall	b	9.4	" 22	" 7	" 24	9	l	r c	d c	8.5	9
Marston	p	9	" 23	" 7	" 24	8.5	m	r d c	l r	7	8.8
Mary	p	9	" 20	" 10	" 26	7.5	l	b d c	b c	7	9
Maumee	b	9.8	" 21	" 7	" 24	9.2	l	r c	b s	7.8	7.5
Maxwell	b	8.8	" 20	" 7	" 25	8	m	r c	d c	8	9
Mayflower	b	9.8	" 20	" 2	" 20	8.5	m	l r c	b s	8	8
McKinley	b	8	" 20	" 6	" 25	9	m	l c	d c	9.4	9
Meridian	p	9.1	" 21	" 6	" 26	9.5	m	r c	d c	7.5	8
Michigan	b	9	" 23	" 16	July 5	8.5	l	b c	b c	9.8	9.8
Mineola	b	8.5	" 21	" 8	June 26	4	m	r c	d s	7.5	7.5
Morgan Favorite	b	9.6	" 21	" 7	" 24	9.5	l	r c	b c	9.8	9.2
Nan	b	8.8	" 22	" 7	" 24	8	m	r c	l c	9.2	9
No. 15 W	b	8	" 23	" 7	" 21	5	m	r c	l s	8	7
No. 1,000	p	9.2	" 23	" 10	" 25	8	l	b c	b d c	9	9
No Name	b	8.2	" 22	" 7	" 21	6	l	b c	d c	9	9
Omega	p	8.4	" 22	" 10	" 26	8.5	l	r c	v d c	9.2	9
Ona	p	8.8	" 22	" 7	" 24	7.5	s	r c	b d s	9.8	8.5
Oriole	p	8	" 23	" 8	" 23	8	m	r c	b s	9	9
Orono	p	9	" 19	" 10	" 26	9.5	s	r c	v d c	8.5	9
Oscar	b	9.8	" 19	" 4	" 22	8	l	r c	b c	8.5	8

STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness.	Size.	Form.	Color.	Quality.	Firmness.
Otsego	p	7	May 24	June 7	June 24	7	m	r d c	l s	8	8
Paris King	b	8.5	" 19	" 7	" 21	9	m	c	d s	8.5	8.5
Parker Earle	b	9	" 23	" 10	" 27	8.5	m	d c	d s	8	9
Patrick	b	8	" 19	" 7	" 24	9.5	s	b c	l s	8	9.4
Peabody	b	9.2	" 20	" 8	" 25	8.8	m	b c	b s	7.8	7.5
Pet	b	7.5	" 22	" 9	" 26	9	m l	b c	b d s	9.2	9
Phippen	b	9.2	" 20	" 7	" 23	7	m	l c	b c	8.8	9
Plow City	b	8.5	" 22	" 9	" 25	9	m	l c	b s	9	8.5
Pride of Cumberland	b	9	" 21	" 9	" 25	7.5	m	r c	b s	8	7.8
Princeton Chief	p	9.5	" 23	" 12	" 26	9.2	l	l c	d c	8.5	8.8
Portage	b	9.4	" 21	" 10	" 26	9	l	l c	b s	8	9
Purdue	p	8.5	" 24	" 7	" 27	9.5	l	r c	d s	8.5	9
Quality	b	5	" 24	" 10	" 25	------	l	r c	b c	10	8.8
Richmond	b	8.8	" 24	" 8	" 27	9	l	b c	d c	9.5	8.5
Ridgeway	b	9.5	" 20	" 9	" 26	9.4	l	r c	b c	9	8.5
Rio	b	9	" 22	" 6	" 25	7	m	l c	b s	9	8.5
Robinson	b	9	" 20	" 10	" 25	9	m	r c	b c	7	8
Ruby	p	9	" 22	" 11	" 26	9.4	l	r d c	b r	9.5	9.5
Satisfaction	b	8.8	" 21	" 8	" 24	8	s m	l c	b d c	9.8	8.8
Seaford	p	------	" 21	" 8	" 26	------	l	b c	d c	9.8	8.8
Sherman	b	9.5	" 21	" 7	" 23	9.5	l	r c	d c	8.5	9
Shyster	p	9 6	" 20	" 5	" 20	9	l	b c	b l s	8	8
Smalley	p	8.8	" 22	" 7	" 24	8	m	r c	d c	7.5	9.8
Smith	b	9	" 22	" 4	" 21	8	s m	r c	r	8	8
Snowball	b	9.6	" 22	" 6	" 25	8	m	l c	b s	8.5	9
Sparta	b	9.8	" 20	" 7	" 24	7.5	s m	l c	d c	9.5	9.5
Splendid	b	9	" 22	" 9	" 25	9	m	d c	d s	9	9
Stahelin	p	9.5	" 21	" 8	" 26	9.2	l	r c	v d c	9.5	8
Staples	b	8	" 21	" 5	" 21	7.5	s	l c	v d c	9	8.5
Star	b	9.5	" 21	" 12	" 27	7.5	l	b c	b s	9	8
Stevenson	p	6	" 21	" 6	" 24	4	s	r c	d c	9.5	8
Stewart	b	9.4	" 23	" 4	" 22	8.5	s m	d c	d c	8	9.2
Stone	p	9.8	" 20	" 4	" 20	9	m l	l c	b s	8.8	8
Sunnyside	p	8.8	" 22	" 10	" 26	7.5	l	r c	l s	8.5	8
Sunrise	p	9	" 22	" 9	" 24	8	s m	r c	b s	8.5	8.5
Tennessee	b	9.8	" 20	" 7	" 25	9	l	r c	d c	9.5	9
Tennyson	b	8	" 24	" 9	" 24	7	m	r c	l s	9.5	8

STRAWBERRIES.—CONCLUDED.

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness.	Size.	Form.	Color.	Quality.	Firmness.
Thompson No. 40	p	9.6	May 21	June 10	June 26	9.5	m	r c	b c	8.5	8.5
Thompson No. 64	p	9	" 20	" 7	" 25	9.3	m l	i r c	b d s	8.5	9
Thompson No. 66	p	8.8	" 20	" 10	" 26	9.8	m	rd c	bdc	9.4	9.8
Thompson No. 103	b	8.5	" 21	" 9	" 24	8.7	l	r c	v b c	9	9
Timbrell	p	8.8	" 22	" 11	" 28	8.5	l	r c	v d c	9	8
Tonga	p	9.2	" 23	" 9	" 24	9.1	m	i r c	s	8	9
Topeka	b	8.5	" 20	" 8	" 24	7.5	m l	l c	d c	8	8.5
Tubbs	b	8.8	" 21	" 7	" 22	8	m	r c	b c	9	7.5
Unnamed	b	9.8	" 22	" 12	" 27	9.2	v l	b l c	b d s	9.4	8.8
Warfield	p	9.5	" 20	" 6	" 23	9.4	m	l c	d c	8.5	9
Weston	p	8	" 22	" 8	" 23	9	l	b c	b c	8	8.5
Wetzell	b	9.4	" 24	" 9	" 24	7	m l	r c	l s	8	7.5
Whitney	b	9.1	" 22	" 10	" 25	5	l	i	b s	8.5	8
Wm. Belt	b	9.8	" 22	" 10	" 27	9.5	l	l c	l c	8.5	9
Woolverton	b	8.5	" 22	" 10	" 26	9.2	m	l c	d c	8	9
World's Champion	p	8.8	" 20	" 7	" 24	8.5	m	b c	d c	7.8	8
Wyatt	b	9.6	" 22	" 9	" 25	7.8	m	r c	d c	9.5	8.5
Yates	b	9.8	" 21	" 7	" 20	5	l	rb c	l s	9	7
Zula	b	7.5	" 19	" 7	" 20	7	s	l s	d b c	8.5	8.5

The following are new sorts, fruiting here for the first time during the past season:

Arkansas Traveler.—Plants received from Columbian Grape Co., Kingston, Ohio. Perfect flower. The variety seems lacking in vigor and in plant making qualities. The berries are large in size, round or broad conical form and of a bright, dark crimson color; quite attractive in appearance. The flesh is light, juicy, of fair quality and moderately firm. The fruit truss is short and most of the berries lie on the ground. Further trial may show the variety to be of more vigorous growth.

Avery.—Received from Matthew Crawford, Cuyahoga Falls, Ohio. Imperfect flower. Many of the plants failed to grow and those remaining are not strong. The fruit is of medium size, long pointed or broadly conical in shape and of a bright dark scarlet color. The flesh is dark, juicy, of high quality but not very firm. The plant and fruit closely resemble Haverland. The variety bore a large crop of fruit for the plant growth.

Bismarck.—From C. N. Flansburgh, Leslie, Mich. Perfect flower. The plants are of rather small, low growth. Berries very large, short, round conical form, color, dark crimson. The flesh is dark, of fair quality and moderate firmness. The plants did not form many blossoms but all the fruits were uniformly large. A promising variety to grow under high culture for large fancy fruits.

Bryant.—Plants from Birdseye & Son, Middle Hope, N. Y. Perfect flower. The plants are of strong, healthy growth. Berries large in size, round or broad conical, often irregular in shape, bright dark crimson color, handsome in appearance. The flesh is dark, lacking in juice, rather poor in quality, but firm. The variety ranks high in productiveness, and the attractive appearance of the fruit, together with its firmness, should make it valuable as a market berry.

Burnett.—Received from Thompson's Sons, Rio Vista, Va. Perfect flower. The plants are of rather weak growth. Berries large, short, round conical form, color bright crimson. The flesh is dark, not juicy, but of high quality. Plants too weak to judge the variety.

Canada Wilson.—Plants received from Birdseye & Son. Perfect flower. The berries are very firm, of good form and appearance, but are too small to make the variety valuable for market purposes.

Carrie.—Plants from Thompson's Sons. Imperfect flower. Medium in plant growth. Berries large, conical in form, and of a dull dark crimson. The flesh is dark, somewhat salvy and lacking in quality, while the long form is objectionable in a market sort.

Cobden Queen.—Plants from Columbian Grape Co. Imperfect flower. The plants are very strong and healthy. Berries large, round or depressed conical, very regular in form and of a light scarlet. The flesh is usually light colored. As grown here the berries are often hollow and lack quality and firmness. The variety made an excellent showing in hill culture.

Dollar.—Plants received from E. J. Hull, Olyphant, Pa. Perfect flower. The plants are of a good healthy growth, but do not make plants freely. Berries large, usually long conical in form, and light bright scarlet in color. Flesh bright, juicy, of good quality and firm. Promising in the size, handsome appearance and quality of the berry, but scarcely productive enough to rank high as a market sort.

Evans.—From Thompson's Sons. Perfect flower. Plants are strong and healthy in growth. The berries are usually large, round conical in form and of a light scarlet color. The flesh is light and lacks juice, but of good quality. The berries are too light in color and rather soft, and the plants are unproductive.

Fountain.—Plants from Slaymaker & Son, Dover, Delaware. Perfect flower. Berries large in size, broad conical, very regular and even in form. The color is a very bright dark crimson. The flesh is dark, juicy and of good quality. The plants are productive and the attractive appearance of the fruit, combined with its good form, high quality and firmness, make it one of the most promising sorts grown here this season.

Hall Favorite.—Received from L. J. Farmer, Pulaski, N. Y. Perfect flower. Plants are lacking in vigor of growth. Promising in berry, but the plant growth was too weak to properly judge the variety. Further trial is necessary.

Hatch Experiment Station.—Plants are of weak growth and make very few runners. Berries very large, sharp-pointed conical in form and of a dark crimson color. The flesh is dark, and while not juicy is of high quality and moderately firm. In size, form and quality of berry it ranks high. The color of the fruit is dull. The variety was very productive for the amount of plant growth.

Herbst.—Plants from J. L. Herbst, Sparta, Wis. Perfect flower. Plants of medium growth in matted rows, but quite strong in hills. Berries of medium size, large flattened conical in form and of very dark crimson color. The flesh is dark, juicy and quite acid. The fruits are firm enough to stand shipment well and are of good color; they ripen unevenly and the under side is green when the top is well colored.

Hilton Gem.—Received from L. J. Farmer. Perfect flower. The plants are of strong, healthy growth, and quite productive. Fruits large, long or round conical in form, and of a bright dark scarlet The flesh is bright, juicy, of good quality and moderately firm. The fruits ripen somewhat unevenly, but are of good appearance, and while the variety has some merit, it is not worthy of special prominence.

Hood River.—From Slaymaker & Son. Perfect flower. The plants are of good growth and healthy foliage. Fruit of medium size, short, round conical form and dark, bright crimson color; seeds large, yellow and prominent, making the berry of very attractive appearance. The flesh is dark, rich and juicy. If the fruits were of larger size the variety would be a very valuable one for market or home use.

Hoosier.—Plants received from Ran Benoy, Matthews, Ind. Perfect flower. Plants of very strong, healthy growth. Berries very large, rather long, flattened conical or round conical in form; color, dark crimson; flesh dark, rich color, of high quality and firm. The fruit truss is large and stout, usually supporting fruit from the ground. The plants were very productive, the berries large, attractive, of high quality and firm. A variety of much promise.

Howell No. 2.—Received from E. J. Hull. Perfect flower. The plants are of rather weak growth, but the foliage is healthy. Fruits are large, long, flattened conical in form and bright dark scarlet in color, flesh very bright, juicy, high quality and quite firm. In attractiveness and quality of berry this variety has few superiors, but it was only moderately productive the past season.

King Worthy.—Plants from Edw. W. Cone, Menominee, Wis. Perfect flower. Plants are of quite strong individual growth, but make few runners. The fruit is large, round sharp conical in form and of light, dull scarlet color. The flesh is light, of fair quality but quite soft. The color of the berry and its lack of firmness are against it as a market sort.

Knight.—Perfect flower. Plants of very strong, healthy growth. Fruit large, round or broad conical in form, bright scarlet color, seeds yellow and prominent. The flesh is bright, of high quality and firm. Productive. Judging from this season's trial, the variety is worthy a place among the best sorts.

Little No. 7.—From J. Little, Granton, Ont. Perfect flower. Plants of very strong, healthy growth. Berries of medium size, usually round, sharp pointed conical in form, color a dull scarlet; flesh bright, good quality and quite firm. The berries average too small in size to be valuable for market and their color is not attractive.

Little No. 8.—Plants from J. Little. Perfect flower. Plants of good growth. Berries of medium size, broad conical in form, and bright crimson in color. The fruits are attractive in appearance, of high quality and quite firm, but too few are borne to make the variety valuable as a market sort.

Little No. 40.—Plants from J. Little. Imperfect flower. The plants are of excellent growth and the foliage is healthy. The fruits are very large in size, broad conical, very regular and even in form; the flesh is usually light in color, of good quality and firm. The productiveness of the variety together with the large size of the berry, its attractive appearance, good quality and firmness of flesh make it a very promising market sort. The fruits, however, do not color evenly.

Manwell.—Received from Edw. W. Cone. Perfect flower. Plants of fair growth but are not so good plant makers as would be desirable. The fruits are very large, broad conical, usually ribbed, and dark crimson in color; the flesh is dark, juicy and rich. The plants are productive and the fruit has the qualities necessary to make the variety a very promising market sort.

Maumee.—Plants from Stayman & Black, Leavenworth, Kan. Plants of very strong growth and productive. Berries large, round or flattened conical in form and bright scarlet color. Promising in plant growth and productiveness, but the fruit lacks quality and firmness.

Mayflower.—Plants received from W. C. Babcock, Bridgman, Mich. Perfect flower. The plants are of very strong and healthy growth. The berries are of a medium size, long round conical form and of a bright scarlet color. The flesh is bright, juicy and of fair quality and moderate firmness. This variety was as early as any to ripen and the fruits color evenly and are attractive in appearance. Promising as an early sort.

McKinley.—From Ellwanger & Barry, Rochester, N. Y. Perfect flower. The plants did not get a good start and the growth was not satisfactory. Fruits of medium size, rather long pointed conical in form, often with slight neck; color dark crimson; flesh dark, bright and of good quality. The berries are much like Warfield in size and shape, but the color is not so dark or bright, and the quality is better. The plants were fairly productive, but further trial is necessary before judging plant growth and productiveness.

Michigan.—Received from J. T. Lovett Co., Little Silver, N. J. Perfect flower. Plants of medium growth. Berries large, round or broad conical in form and bright crimson color. The flesh is dark, of a good quality and very firm. This was the latest variety, by several days, to ripen fruits. In size, color, quality and firmness of fruit, the variety ranks high. If on further trial the plants show more vigorous growth it will be a most valuable late variety.

Mineola.—Plants from Slaymaker & Son. Perfect flower. The plants are of low, small growth. Berries of medium size, short round conical form; flesh light, in color, soft and rather poor in quality. Very few fruits borne. The variety was of little value as grown here this year.

Morgan Favorite.—Plants from W. F. Allen, Jr., Salisbury, Md. Perfect flower. Plants of strong growth and the best foliage in the plot. Fruit very large in size, round sharp pointed conical form and bright dark crimson color; flesh bright, juicy, of high quality and firm. The variety was productive and but very few small berries were borne. The plant and fruiting qualities of this variety are such as to make it well worthy of trial for home use or for market.

Omega.—From Thompson's Sons. Imperfect flower. The plants are of fair growth. Fruit large in size, short round conical form, very dark crimson color, seeds yellow and prominent. The flesh is bright, juicy and of good quality. In attractive appearance and quality of fruit the variety ranks high. It was but moderately productive the past season.

Patrick.—Received from Edw. W. Cone. Perfect flower. Plants of medium growth. Fruit small in size, long or broad conical form, light scarlet color. The plants were productive, but the berries were too small.

Peabody.—Plants from J. Little. Perfect flower. The plants are of excellent growth and healthy in foliage. Fruit of medium size, round or broad conical in form and bright light scarlet color. Too many of the berries are small, the color is not attractive, the quality is poor and the fruit lacks firmness.

Pet.—Plants received from E. J. Hull. Perfect flower. Plants are not of strong growth and made few runners. Fruit medium to large in size, broad conical form and a bright dark crimson color. The flesh is bright, of good quality and firm. A good variety, but seems to have no qualities of special merit.

Pride of Cumberland.—From Slaymaker & Son. Perfect flower. Plants of fair growth. Fruit of medium size, round conical form with slight neck, color a bright scarlet. The berries are often hollow and the flesh is mealy and lacking in firmness.

Quality.—Received from M. Crawford. Perfect flower. The berries are as attractive in appearance as any grown in the plot; are large in size and of the highest quality. The plants made but little growth and the productiveness of the variety could not be determined.

Ridgeway.—Plants from M. H. Ridgeway, Wabash, Ind. Perfect flower. Plants of excellent growth and a good foliage. Fruit large, short, round conical in form and a bright crimson color. The plants are productive and the fruits very even in form, attractive in appearance, of good quality and firm enough to stand shipment well. A variety of much promise.

Satisfaction.—From Slaymaker & Son. Perfect flower. Plants of fair growth. Berry small to medium in size, round, rather long conical in form, and dark, bright crimson color. The fruits are handsome in appearance and have a high, aromatic flavor. An excellent dessert fruit, but the berries are too small for a market variety.

Seaford.—Received from L. J. Farmer. Imperfect flower. The plants of this variety were received late in the season and but a small growth was made. The berries are very large, long, broad conical in form, color a dark, rich crimson. The quality is very high and the berry is quite firm. Further trial is necessary to judge growth and productiveness. Under the unfavorable circumstances the showing was excellent. A variety of much promise.

Shyster.—Plants from Thompson's Sons. Imperfect flower. Plants of very strong growth and quite productive. Fruit large in size, broad conical somewhat ribbed in form, light scarlet color, quite attractive; fresh bright, juicy, but sour, moderately firm. The foliage blighted quite badly and the fruits did not ripen well at the tip.

Star.—Plants from E. W. Reid, Bridgeport, Ohio. Perfect flower. The plants are of good growth and have healthy foliage. Fruit large, broad conical in form, color light bright scarlet; flesh bright, somewhat mealy, but of good quality. The plants were not as productive as could be expected from the good growth and the berries are scarcely firm enough to stand shipment well.

Stevenson.—Received from Edward Stevenson, Stevensville, Mich. Imperfect flower. The plants did not make a good growth and many were attacked by blight. Fruit small, short, round conical in form and dark crimson in color; flesh bright and of high quality. The berries are too small and the plants lack vigor and productiveness.

Stone.—From J. Little. Imperfect flower. Plants of very strong growth and foliage healthy. Fruit medium to large in size; long conical form, color bright scarlet. The flesh is bright, juicy and of fair quality, but moderately firm. It is early in season and the fruits are large for a variety ripening at the period it does. It holds out well in length of season though the last fruits are not large. Well worthy of trial as an early ripening variety.

Unnamed.—Received from J. Little. Perfect flower. The plants are of vigorous growth and have a healthy foliage. Fruits very large in size, of broad, long conical form, usually ribbed, color a bright scarlet. The flesh is dark, not juicy, but of high flavor, firm. The fruit-stem is large and stout, quite supporting the fruit from the ground. Very promising because of the vigor and productiveness of the plant, and the large size and good quality of the fruits.

Wetzel.—From J. Little. Perfect flower. Plants of good growth. Fruits medium to large in size, form short, round conical, color light scarlet. The berries are too light in color and too much flattened in form, while the plants lack productiveness.

Whitney.—Plants received from E. J. Hull. Perfect flower. The plants made a good growth, but did not set much fruit. The few very large berries borne were ribbed and irregular in form and of a bright scarlet color. Most of the blossoms failed to set fruit and many of the berries were imperfect. Of little value the past season.

World's Champion.—Plants from E. J. Hull. Imperfect flower. Plants of medium growth and but moderately productive. Fruit medium in size, round or broad conical in form and dark crimson in color; flesh dark, juicy, but sour. Plants lack productiveness and size of berries.

NEW VARIETIES OF 1897.

The following sorts were described at some length in the report of last season:

Arrow.—The plants are vigorous and fairly productive of fruits that are high in quality. The long narrow form of the fruit is against it as a market sort.

Bostonian.—Excellent in plant growth, but lacking in productiveness. The fruit is of good color and high quality, but many of the berries are small and imperfect.

Cherokee.—The plants are of fair growth and moderately productive, but while the berries are of good quality and quite firm, they are too small to be valuable.

Dakota.—Excellent in plant, but while a good crop of fruit was borne, the berries were too soft and small to make it a good selling variety.

Fremont.—The plants are of very strong growth and productive. The berries are of good form, fine appearance and good quality, and the crop holds out well in season. If the fruits were a little larger the variety would rank well up with the best.

Gen. Fifer.—Has developed no qualities of special merit.

Gertrude.—The plants are of good growth. Few berries were borne and most of those were small and imperfect in form. Of little value as grown here for two seasons.

Giant.—The plants were of stronger growth and more productive than last last season. The fruit is attractive, of good quality and firm. It seems worthy of extensive trial.

Glen Mary.—Plants of good growth and healthy foliage. The variety is productive and the fruits large, of good quality and firm. Well spoken of wherever tried. One of the most promising sorts for market.

Granville.—Many of the berries are below salable size and the plants were not productive. The variety has no points of special prominence.

Homestead.—The variety was much more productive than last season, but the fruits are small and irregular in form.

Ideal.—Excellent in plant and the fruit is very attractive in appearance, of high quality and firm. Well worthy of being planted for home use or for market.

Jerry Rusk.—The plants were of scattering growth and quite badly attacked with blight. The berries are too small in size though of good quality and firm.

Karl.—This year as last the plants were the strongest in growth of any in the patch, but very few fruits were set and those borne were small and imperfect.

Lanah.—The plants were of good growth, more productive than last season and the berries of large size. Of some merit though not likely to occupy a prominent place.

Marston.—Good in plant growth and fairly productive. The berries are too small, the color unattractive and the quality low.

Nan.—Plants of fair growth and healthy. The berries were larger in size than last season and produced in greater number. The color and quality is good, but the variety is not productive enough to warrant extensive planting.

No. 1000.—Vigorous and healthy in plant growth and fairly productive. The fruits are very attractive in appearance, of high quality and firm, and although none are very large, there are few small ones. A good variety.

Phippen.—The plants are of very good growth, but poor in foliage. The fruits are of fair quality and firm, but lack in size and numbers.

Plow City.—The plants are of stronger growth than last season, but are not good runner makers. The fruits are of good size, form and color and hold out well in season. Appears a promising sort.

Portage.—This variety has shown up well the past season. The plants are of good growth and productive. The fruits are usually large, of good form and color and of fair quality and firmness. Many of the fruits are hollow or have a hard core. Of considerable value.

Purdue.—The plants were of only fair growth, but produced an excellent crop of fruit. The berries are of good size and quality, and are quite firm. It has a long season and the fruits hold up well in size. Seems worthy of trial as a market berry.

Ruby.—While the plants are of rather weak growth, the berry is nearly all that could be desired in form, color, quality and firmness. The size is good, but it is not among the largest. Worthy of extended trial.

Sparta.—The plants were of very strong growth and healthy in foliage, but set few fruits and those were small in size, and of imperfect form. The berries are of high quality and firm. Of doubtful value.

Sunrise.—Good in plant growth, but lacking in productiveness and size of fruits.

Tubbs.—Plants are of fair growth and healthy. The berries are of good color and quality, but are too small and too soft for market.

Beebe, Blonde, Bouncer, Champion, Cruse No. 9, Dictator, Early Bird, Equinox, No. 15, W., and Smith were quite unsatisfactory in fruit or plant.

The following are older and better known sorts, that have been tested for at least three seasons:

Aroma.—Has made an excellent showing for several seasons as a berry of large size, high quality and good appearance. The plants are of good growth, but are only moderately productive.

Beder Wood.—Is largely grown as a fertilizer for pistillate sorts. The berries are rather soft and of a light color and the plants are often much injured by leaf blight.

Bird.—Did not make as good a showing this season as in the past. It still seems deserving of trial as a market berry.

Brandywine.—The fruits are large, of high quality and attractive appearance. One of the most promising of the large fruiting varieties for market or home use. The season is medium to late.

Bubach.—Is a well-known large fruited sort, especially adapated by strong soils, where it is one of the most valuable varieties.

Clyde.—On soils not easily affected by drought this is a very profitable variety. The berries are rather light in color and but moderately firm. An excellent fertilizer for pistillate varieties.

Crescent.—An old sort now being superseded by larger fruiting varieties. Productive, but towards the end of the season the berries are likely to be quite small.

Gandy.—Is largely planted as a late ripening variety. The fruits are large, of high quality and firm. The variety is moderately productive, but holds out well for several years.

Greenville.—Excellent in plant growth and productive of large fruits. The berries are not firm enough to stand stipment well; in other respects it is a valuable variety.

Haverland.—One of the most profitable varieties for home use or market. Productive. Fruits of good size and quality, and moderately firm. A good seller.

Kansas.—Excellent in plant growth and productive. The fruits are of good quality and firm. On strong soils and under high culture the variety would be valuable for market.

Kossuth.—The plants are of strong healthy growth, but are moderately productive. The fruit is of high quality and firm, but lacking in size.

Leroy.—The plants are strong and healthy in growth and have been uniformly productive of large crops of fruit. The berries are large, fine color, regular in form, of high quality and firm. An excellent market variety.

Marshall.—This season the plants were of strong growth and productive. The berries are large, dark red and uniform in size, of good quality and firm. The foliage is somewhat subject to rust except upon strong, moist soils. One of the most promising large fruited varieties.

Parker Earle.—On a strong soil with plenty of moisture this is a good late market berry. The color is light and the quality is not high. It usually sets too many fruits.

Princeton Chief and Mrs. Cleveland are good in plant growth, productive, and the fruits are large and of excellent quality. They are valuable for home use or near market.

Richmond.—The plants were of good growth and made a much better showing in productiveness than last season. The berries are not very large, but all are of good size; they are attractive in appearance, good in quality and firm. If the berries were of large size, it would be a very valuable sort for market.

Sherman.—Plants of very strong, healthy growth, and productive. The fruits are large, good in color, of high quality and firm. The berries hold out well in size to close of season. This variety has been grown three seasons with excellent results.

Splendid.—If the fruits were of larger size this would be a valuable market variety. It takes high rank in other respects.

Stahelin.—The plants are of strong, healthy growth and productive. The berries are large, somewhat irregular in shape, of fine appearance and high quality, but rather soft. Valuable for home use or near market.

Tennessee.—Very strong and healthy in plant growth and productive. The fruits are large, of good color, firm and of high quality. The berries hold out well in size to close of season. A valuable variety for home use, or for market.

Timbrell.—A variety bearing large fruits of good quality. Its color is against it as a market berry. A good table sort.

Warfield.—One of the most profitable market berries grown. The variety is very productive and the dark rich color of the berry makes it a good seller. If the size of the fruits could be increased and the quality improved it would be the ideal berry.

Wm. Belt.—Last season this variety made an excellent showing in plant growth and bore a good crop of large, well formed fruits. It is one of the most promising of the large fruited sorts for market purposes.

SUMMARY OF VARIETIES.

The most promising of the new sorts are Fountain, Hoosier, Knight, Morgan Favorite, Ridgeway, Seaford, Unnamed and Mayflower for early and medium, and Michigan for late.

Of the varieties that have been tested for two seasons the following have the most promise: Fremont, Giant, Glen Mary, Ideal, Purdue, Plow City, Ruby and Wm. Belt.

Notwithstanding the advent of many newer sorts, it is doubtful if there are more profitable varieties for the market grower than Bubach, Haverland and Warfield with Beder Wood, Sharpless or Clyde as fertilizers for these pistillates.

For the grower of fancy fruit under intensive culture, it is possible that the large fruiting sorts Brandywine, Glen Mary, Marshall and Wm. Belt may be more profitable than the varieties named above that are usually more productive but bear smaller berries.

Bird, Greenville, Leroy, Snowball and Weston, among sorts not so widely known as the above, have given good results as market berries.

Aroma and Eureka bear large fruits, are late and have a long season. They are well worthy of trial as late varieties.

L. R. TAFT.
H. P. GLADDEN.

Agricultural College, Mich.,
Oct. 15, 1898.

METHODS AND RESULTS OF TILLAGE.

BY M. W. FULTON.

Bulletin 164.—Farm Department.

SUMMARY OF RESULTS.

I. When the climatic conditions are normal, as in the fall, winter and spring of 1897-98, and oat ground is to be plowed before sowing, it is better, as far as the yield of grain is concerned, that the plowing be done in the fall. In the experiments reported in this bulletin there was a difference in yield of over nine bushels per acre in favor of the plots plowed in the fall over those plowed in the spring.

II. Rolling sandy loam for oats is indicated as good practice whether the rolling be done before or after the oats are drilled, although the difference in yield, attributable to variations in methods of preparation of the soil, was small.

III. Frequent cultivation of corn keeps the land moist and increases the total amount of water available to the crop.

IV. Such cultivation concentrates the moisture near the surface, where it is more readily secured by the plant.

V. Plots cultivated frequently yielded 86.6 per cent more dry matter than uncultivated plots and 17.1 per cent more dry matter than plots cultivated infrequently.

VI. Uncultivated corn not only gave a very small yield but the corn as cut up for silage, was inferior in quality.

VII. Plots cultivated three inches deep yielded on the average 8.3 per cent more than plots cultivated five inches deep.

VIII. Frequent cultivation to a depth of three inches gave the best results in these experiments and is recommended for general practice.

IX. Wheat ground dries out very rapidly while the crop is ripening. The decrease in moisture in the upper three feet was found to be 16.27 per cent within one week. Drying out does not cease when the wheat is cut. Later if the season be dry a loss of more than 15 per cent of the moisture remaining when the wheat is harvested may be expected.

X. In the early spring unplowed land was found to contain more moisture than fall plowed land adjacent. Later in the season the reverse was the case.

XI. An important saving in soil moisture was effected by early spring plowing. Early plowing with thorough preparation of the plowed land will do much to prevent the loss of soil moisture.

DETAILS OF THE EXPERIMENTS.

The experiments reported in this bulletin are a continuation of a series begun at this Station and partly reported in Bulletin 154, pages 267 to 272. The method of taking, drying and weighing the soil samples was the same as there reported, and the method of determining the per cent of moisture was also the same, the weight of the dry soil being taken as the basis of calculation. All samples unless otherwise noted were taken in foot sections to a depth of three feet.

EXPERIMENTS IN THE PREPARATION OF OAT GROUND.

Fall vs. Spring Plowing.—This set of experiments compares, first, fall plowed and spring plowed land; second, land not rolled with that rolled before drilling, rolled after drilling, and rolled and harrowed after drilling. The plots were located in two separate fields. In field No. 15, one set of experiments was tried on fall plowed land and in field No. 8 two sets were tried, one on spring plowed and one on fall plowed land. Each set contained four plots, so that each method of preparation, with respect to rolling, was tried on three separate plots and in two different fields.

The soil in No. 8 is reasonably uniform and the mechanical analysis found on page 267 of Bulletin 154 gives an idea of its general character. No. 15 is more rolling than No. 8, and the soil is also a little lighter, consequently its normal content of water is lower.

No. 15 was a timothy and June grass sod and its general preparation was as follows: Plowed the latter part of October, 1897; worked with spading harrow lapping half, April 13, 1898, going lengthwise of the furrow; harrowed twice with spring tooth harrow in the same direction, April 14th; cross harrowed with spike tooth harrow, April 14th and 15th; the oats, American Banner, were sown with an eleven hoe grain drill, April 15th.

The plots were made very narrow, two drill breadths, (fourteen feet) wide, and ran from near the west end of the field to the east end. The extreme length included was seventy-two rods. The special preparation of the various plots was as follows:

Plot 1. Not rolled.
Plot 2. Rolled before drilling.
Plot 3. Rolled after drilling.
Plot 4. Drilled and afterwards rolled, then harrowed with spike tooth harrow.

In connection with the growth and harvesting of these plots the following points should be noted:

April 30th the oats were just coming through the ground.
June 25th they were well headed out.

The cutting and shocking was done July 25th and the hauling August 3d. All the experimental oats were threshed October 8th. No marked difference in the growth of the oats on the several plots was noted at any time, but the oats in this field were much shorter than those in No. 8.

Field No. 8 grew corn in 1897, and the following will make clear the preparation of the two strips on which the oat experiments were duplicated. The fall plowing was done early in November and the land left with no further preparation until spring; April 16th this fall plowed strip was worked once with a spading harrow; April 18th it was worked lengthwise with a spring tooth harrow and April 21st cross dragged with the same harrow. The spring plowed strip was plowed April 12th and 13th. It was not worked with a spading harrow, but otherwise its treatment was exactly the same as that given the fall plowed strip up to the time of the special preparation of the individual plots.

The plots had the same width as in No. 15 and were ninety rods seven and one-half feet long.

All of the plots except Plot 5 were drilled April 25th. Plot 5 was left until April 26th on account of rain.

The following shows the preparation of each plot:

Fall Plowed.

Plot 1. Rolled and harrowed with spike toothed harrow April 30th, after drilling.
Plot 2. Rolled April 30th, after drilling.
Plot 3. Rolled and drilled April 25th.
Plot 4. Not rolled.

Spring Plowed.

Plot 5. Rolled and drilled April 26th.
Plot 6. Drilled then rolled April 30th and afterwards harrowed with spike tooth harrow.
Plot 7. Rolled April 30th after drilling.
Plot 8. Not rolled.

On account of rain the rolling and harrowing after the oats were drilled was not done until April 30th.

May 7th the oats were well up, June 25th they were just heading out; they were cut July 27th and hauled to the barn August 6th.

Determinations of the moisture in the plots of No. 15 were made on five different dates, April 16th, 28th, May 5th, 12th and 24th.

Similar determinations were made in No. 8 on April 30th, May 13th, 31st, and June 7th.

AVERAGE PER CENT OF MOISTURE IN OAT PLOTS AND YIELD.

No. 15. Fall plowed.	1st foot.	2nd foot.	3rd foot.	Average for three feet.	Yield per acre. lbs.
Plot 1, not rolled	14.27	13.25	16.03	14.52	1,534
Plot 2, rolled before drilling	14.15	13.01	15.29	14.15	1,626
Plot 3, rolled after drilling	15.39	15.65	15.43	15.49	1,550
No. 4, rolled and harrowed after drilling	12.39	12.57	15.91	13.62	1,660
General average				14.44	1,592
No. 8. Fall plowed.					
Plot 1, rolled and harrowed after drilling	14.79	14.60	14.57	14.65	1,510
Plot 2, rolled after drilling	15.39	15.65	15.43	15.49	1,702
Plot 3, rolled before drilling	15.67	15.54	15.56	15.59	1,585
Plot 4, not rolled	14.06	14.20	15.20	14.49	1,535
General average				15.05	1,583
Spring plowed.					
Plot 5, rolled before drilling	13.35	13.29	14.72	13.79	1,333
Plot 6, rolled and harrowed after drilling	13.46	15.53	13,98	14.32	1,308
Plot 7, rolled after drilling	13.47	13.72	14.70	13.96	1,373
Plot 8, not rolled	15.31	15.28	14.75	15.11	1,365
General average				14.29	1,345

The preceding table shows in No. 8 a marked difference in moisture in favor of the fall plowed land. In one case alone does a plot plowed in the spring have an equal or larger amount of moisture than any plot of the fall plowed land. The average per cent of moisture to a depth of three feet for the fall plowed exceeds by .76 per cent that for the spring plowed. This means a difference in favor of the fall plowed land of about forty-five tons of water per acre. The difference was not apparent until May 31st, but was very marked on this and the succeeding date, June 7th. The average excess of moisture on these dates was 1.89 per cent, or 111 tons of water per acre. Attention is here called to the table on page 95, giving the average per cent of moisture for each date on which samples were taken.

The yields in No. 8 show a much greater difference in favor of the fall plowed land than did the moisture determinations. There is not a single instances in which a spring plowed plot equals in yield a plot plowed in the fall. The highest yield per acre on the spring plowed land was 137 pounds less than the lowest yield on the fall plowed. The average yield on the fall plowed is slightly over 23 per cent higher than that of the spring plowed. While, because of variations in conditions, no direct comparison can be made between No. 8 and No. 15, it is interesting to note that the average yield per acre in No. 15 is higher than on the fall plowed land in No. 8. It seems probable that No. 15 derived some considerable advantage from the fall plowing.

Comparison of methods of preparation.—An examination of the table given above does not show, as far as content of moisture is concerned, any marked difference in favor of any one of the special methods of preparation. The results in duplicate plots are completely at variance.

While the yields of these individual plots similarly treated do not agree perfectly, they are still sufficiently in accord to furnish us some instruction. It is to be noted that the sum of the yields of the three plots rolled after drilling is 4,625 pounds, while the yields of the three plots not rolled was but 4,434 pounds, a difference of 191 pounds or 4 per cent of the yield of the plots not rolled. Between the methods of rolling before drilling and rolling and harrowing after drilling there seems to be no appreciable difference. When to use the roller or whether to use it at all depends upon the character of the soil and its wetness. If the land be clay it is dangerous to use the roller in the spring. If it be wet the roller is forbidden altogether. With sand the case is different. Sandy soils are too open in texture as a rule to hold moisture and produce the largest yields. The use of the roller is therefore indicated.

Experiments in oat culture conducted by the Wisconsin Station are reported in the Wisconsin Annual Report for 1890. It was found that rolling increased the moisture in the upper two feet of soil, but samples taken from the surface to below a depth of two feet showed a difference in favor of the unrolled ground. This difference increased with the depth to which the samples were taken.

A larger per cent of germination was found on the rolled ground and consequently there was a better stand of oats. The oats on the rolled land yielded 61.12 bushels per acre by weight while those on the unrolled land yielded 58.89 bushels per acre. The oats from the rolled plot were found to have larger kernels and to weigh more per bushel.

Other Stations have done considerable work on oat culture. The following have secured results favoring fall plowing : Oklahoma, North Dakota, Kansas, Minnesota, while Kansas and North Dakota have found that spring plowing sometimes gives the better results.

Kansas, Minnesota, Illinois and Oklahoma have found results in favor of rolling the seed bed for oats. Ohio found no advantage on heavy clay but on a sandy soil found a marked advantage. Nebraska and Kansas have found that better yields are secured with the press drill than when oats are sown broadcast or with an ordinary hoe drill.

The evidence seems almost uniformly in favor of fall plowing and of compacting the seed bed, when the soil is loose in texture.

CORN CULTIVATION.

FREQUENT AND INFREQUENT, DEEP AND SHALLOW.

This set of experiments was designed to supplement the experiment in the cultivation of corn reported in Bulletin 154, page 268. The ground upon which the tests were made was located in Field No. 6, north of the drive. Two strips of land were used, one lying just west of the center of the field and the other near the west side, the distance between being about twenty rods. The individual strips were very uniform as to soil and quite level, but there was a marked difference in the character of the soil between the east strip and the west strip. The east strip was a sandy loam, inclined to be gravelly below a depth of one foot. The west strip was not quite so sandy at the surface and had more clay below the first foot. In taking soil samples the solid clay was usually reached in the third foot. No mechanical analysis has been made of samples taken directly from these strips, but in 1897 samples were taken across the field in two parallel lines, one just west of the east strip and the other just east of the west strip. The samples from each line, five in number, were quite uniform and were mixed to form a composite sample. The results of the analyses of the air dried soil are given below:

MECHANICAL COMPOSITION OF SOIL FROM THE WEST HALF OF NO. 6.

East strip.	Water.	Organic matter.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Fine silt and clay.
Soil	.54	4.00	7.34	9.99	17.84	29.78	8.67	8.63	14.52
Subsoil	.14	1.68	9.79	11.92	16.03	31.85	9.02	5.63	13.66
West strip.									
Soil	.44	4.10	4.55	6.66	12.07	31.03	13.68	10.29	16.08
Subsoil	.18	1.82	6.25	8.41	15.12	33.93	14.63	6.75	13.22

The above analyses show fairly well the difference in soil between the two strips, except that in the third foot from which no sample for analysis was taken, the difference was most marked, there being a much larger per cent of clay in the west strip than in the east strip at this depth. The two strips, each containing four plots, were six hundred and two feet long. Each plot contained five rows of corn and was eighteen and three-fourths feet wide. The object of having two strips was to duplicate the work as far as possible in every detail and this plan was adhered to throughout the entire experiment. The east strip grew roots in 1897, the west strip was in oats that year, and was plowed in the fall. The preparation of both strips was as follows:

Plowed May 17th and 18th; harrowed with spring tooth harrow, May 23d; cross harrowed with spike tooth harrow, and rolled the same day.

May 24th, planted with two horse planter to Hathaway Yellow dent corn. Worked with a weeder May 28th.

The plots in each strip were numbered from 1 to 4 consecutively from east to west, and the treatment of like numbers was exactly the same. Plot 1 had no cultivation. Plot 2 had frequent cultivation, depth three inches. Plot 3 had frequent cultivation, depth five inches. Plot 4, had ordinary cultivation, depth five inches. By ordinary cultivation we mean cultivated as in ordinary practice.

A "Gale" two-horse cultivator was used until the corn became too large for a two-horse cultivator, after which a "Planet Jr." one-horse cultivator was used. The following is a record of the cultivation throughout the season:

Plots 2 and 3 were worked with a weeder June 3d, 8th, and 18th; with the Gale cultivator June 14th, 20th, 25th, July 2d, 4th, 5th, and 11th, and with the Planet Jr. cultivator July 20th, 29th, August 4th, 12th, 19th, 27th, and September 5th. Plot 4 was cultivated with the Gale cultivator June 14th, 20th, July 4th and 5th, and 11th. The cultivation July 4th and 5th was across the plot, and was the only cultivation in this direction that the plots received. July 20th to 23d the weeds were cut from all of the plots except No. 1, care being taken to disturb the soil as little as possible.

It should be noted that at all times care was taken to cultivate only when the soil was in fit condition. For this reason cultivation was not done at regular intervals. The cross cultivation July 4th and 5th was to a depth of four inches. A mistake was made in allowing the cultivator to go below a depth of three inches in Plot 2, as wherever the cultivator teeth penetrated the undisturbed soil many corn roots were injured.

The following observations were made during the season:

July 2d, soil very much more compact on Plot 4 than on Plots 2 and 3. Plot 1 begins to show the effects of lack of cultivation as the corn has a yellowish tinge and is rather spindling. The ground in this plot is now completely covered with weeds.

July 5th, unthrifty condition of Plot 1 in both strips more marked than before. The moisture in Plot 4 is within one-half inch of the surface, while on Plots 2 and 3 there is a mulch of from one to two inches of dry earth.

July 11th, Plot 2 of the east strip more even and thrifty than any other plot and noticeably larger. Plot 2 on the west strip also more even than the other plots but there is no marked difference in the size of the corn.

July 22d, east strip. Plot 1 has made no growth lately and is dying badly. Plot 2 has a very even growth and is just tasseling. Plot 3, corn somewhat smaller than in Plot 2 and not so even; not so far along in tassel. Plot 4, similar to Plot 3.

July 22d, west strip. Corn not so far along as in east strip. Plot 1 shows the same unfavorable conditions as in the east strip. Plot 2 not so much larger than Plots 3 and 4, but shows the same even growth as in the east strip. Plots 3 and 4 same as in the east strip.

July 27th, corn in the east strip curling from the effect of dry weather. The hot dry weather has affected Plots 2, 3 and 4 about alike. The west strip has not suffered so much from dry weather.

Determinations of moisture were made weekly during the growth of the corn, and a record of these determinations is here given:

Per cent of moisture in the corn plots, No. 6.

EAST STRIP.

	Plot 1.				Plot 2.			
	1st foot. Per cent.	2d foot. Per cent.	3d foot. Per cent.	Average for 3 feet. Per cent.	1st foot. Per cent.	2d foot. Per cent.	3d foot. Per cent.	Average for 3 feet. Per cent.
June 4	9.61	7.95	7.54	8.37	11.84	8.57	12.63	11.01
June 14	13.40	6.52	9.53	9.82	13.59	9.33	7.23	10.05
June 21	8.30	9.53	9.92	9.25	10.63	9.19	8.66	9.49
June 28	12.66	7.93	9.59	10.06	11.97	8.68	11.72	10.79
July 5	5.76	.33	7.93	6.34	8.75	8.59	9.02	8.79
July 12	5.23	5.24	8.14	6.20	7.45	7.26	9.63	8.11
July 19	3.64	4.78	7.45	5.29	4.68	4.73	9.43	6.28
July 26	2.85	3.00	4.32	3.39	3.25	3.96	8.06	5.09
Aug. 2	2.45	2.34	3.93	2.91	2.93	3.99	10.92	5.95
Aug. 9	4.44	2.01	3.51	3.32	5.22	2.39	6.50	4.70
Aug. 16	3.90	2.58	4.58	3.69	3.93	2.99	5.45	4.12
Aug. 23	5.47	2.89	5.80	4.72	6.20	3.07	4.94	4.74
Aug. 30	2.81	2.75	5.42	3.66	3.56	2.75	5.60	3.94
Sept. 7	5.66	2.89	5.59	4.71	6.00	4.61	5.38	5.33
Sept. 12	4.24	4.69	4.68	4.54	5.35	4.54	3.78	4.56
Oct. 1	9.43	5.95	2.65	6.01	7.52	4.93	2.32	3.92
Oct. 22	12.14	9.87	7.56	9.86	11.72	5.72	3.63	7.02
	Plot 3.				Plot 4.			
June 4	10.55	7.21	14.00	10.59	11.81	11.17	17.25	13.41
June 14	13.44	8.46	6.28	9.39	12.53	6.16	12.05	10.25
June 21	11.14	8.41	8.61	9.39	11.33	8.38	9.31	9.67
June 28	12.45	10.03	11.93	11.47	12.00	10.79	10.11	10.97
July 5	8.80	7.23	9.67	8.57	8.53	8.34	8.88	8.58
July 12	8.36	7.97	9.43	8.59	7.98	5.42	10.00	7.80
July 19	7.17	4.91	8.10	6.73	6.21	5.63	8.91	6.92
July 26	3.64	4.86	7.46	5.32	3.35	4.05	8.28	5.23
Aug. 2	3.29	4.26	7.99	5.18	2.45	3.39	6.38	4.07
Aug. 9	5.98	5.99	2.69	4.89	4.07	3.06	4.28	3.80
Aug. 16	3.81	3.48	5.22	4.17	4.29	3.33	6.35	4.66
Aug. 23	5.96	4.10	5.87	5.31	5.25	3.39	5.61	4.75
Aug. 30	3.75	3.51	6.11	4.46	3.38	2.80	5.47	3.88
Sept. 7	6.01	3.25	6.25	5.17	6.68	2.99	5.28	4.98
Sept. 12	4.76	4.08	4.44	4.43	4.30	3.44	8.99	5.38
Oct. 1	7.88	3.73	4.54	5.38	8.05	3.02	2.78	4.62
Oct. 22	13.91	5.07	2.78	7.25	12.86	8.35	5.73	8.98

Per cent of moisture in the corn plots in No. 6.—Continued.

WEST STRIP.

	Plot 1.				Plot 2.			
	1st foot. Per cent.	2d foot. Per cent.	3d foot. Per cent.	Average for 3 feet. Per cent.	1st foot. Per cent.	2d foot. Per cent.	3d foot. Per cent.	Average for 3 feet. Per cent.
June 4	11.28	6.92	12.84	10.35	11.63	8.75	15.27	11.88
June 14	12.16	10.81	13.96	12.31	14.10	9.15	14.61	12.62
June 21	10.24	11.17	12.13	11.18	11.74	6.95	13.96	10.88
June 28	12.02	10.48	17.44	13.31	15.45	9.77	16.90	14.04
July 5	9.66	8.15	14.14	10.65	11.50	10.89	14.61	12.30
July 12	5.38	6.27	13.85	8.50	9.93	10.97	12.98	11.29
July 19	6.21	5.63	8.91	6.92	8.33	6.68	12.29	9.10
July 26	2.89	5.14	11.47	6.50	4.21	5.64	13.03	7.63
Aug. 2	2.23	2.89	7.44	4.19	3.27	4.56	10.49	6.11
Aug. 9	4.90	2.70	5.85	4.48	5.98	4.48	7.21	5.89
Aug. 16	4.90	4.05	11.47	6.81	5.36	5.26	10.93	7.18
Aug. 23	6.86	4.53	10.95	7.45	6.17	4.06	12.12	7.45
Aug. 30	5.54	4.95	10.62	7.04	3.61	5.02	11.61	6.75
Sept. 7	6.02	5.30	13.11	8.14	6.52	3.36	12.31	7.40
Sept. 12	5.80	4.71	11.05	7.19	5.56	3.37	8.19	5.71
Oct. 1	10.92	6.59	9.59	9.03	7.81	4.43	5.03	5.76
	Plot 3.				Plot 4.			
June 4	10.89	10.04	11.81	10.91	8.90	10.63	16.69	12.04
June 14	11.73	9.92	13.67	11.77	10.22	13.27	14.24	12.58
June 21	11.05	7.19	11.09	9.78	10.61	9.73	12.50	10.95
June 28	17.12	9.07	13.04	13.08	13.75	11.30	15.01	13.35
July 5	10.92	11.38	10.53	10.94	9.41	11.29	12.24	10.98
July 12	10.46	10.78	13.24	11.49	9.65	9.10	11.48	10.08
July 19	9.25	7.35	13.81	10.14	10.18	8.18	9.64	9.33
July 26	6.10	6.34	13.21	8.55	4.97	6.50	12.61	8.03
Aug. 2	3.54	5.39	11.21	6.71	3.35	5.04	15.04	7.81
Aug. 9	6.70	3.98	7.43	6.04	4.97	5.08	8.54	6.20
Aug. 16	5.64	4.72	11.19	7.18	4.50	6.85	12.67	8.01
Aug. 23	6.95	5.14	11.05	7.71	6.19	5.84	11.33	7.79
Aug. 30	5.64	6.20	13.79	8.88	4.89	5.78	8.93	6.53
Sept. 7	6.55	5.53	14.38	8.82	6.81	7.53	8.80	7.71
Sept. 12	5.56	5.65	10.20	7.14	5.34	7.62	8.51	7.16
Oct. 1	7.86	5.99	8.81	7.55	10.53	8.58	11.23	10.11

The dates and amount of the rainfall from April 1st to October 31st, 1898, are given in the following table:

Rainfall April 1 to Oct. 31, 1898.

April.		May.		June.		July.		August.		September.		October.	
1	.21	1	.10	1	.16	3	.05	2	.60	4	.20	1	.02
9	trace	9	.12	7	.11	8	.87	3	.10	5	.69	4	.32
16	"	10	.05	10	.33	19	.07	8	.10	6	.08	7	.26
17	.11	14	.02	11	.15	28	trace	15	.15	15	.17	11	.41
19	.83	18	.24	13	.33	29	.10	16	.30	18	.15	12	.03
20	trace	19	.90	18	.47			17	1.16	23	.46	13	.12
22	.54	20	.19	20	trace			24	.02	24	1.25	14	.02
25	.27	28	.33	24	2.50							17	.80
28	.12			27	.33							18	.11
				30	.06							20	.18
												21	.16
												25	.97
												29	.09
												30	.05
	2.08		1.95		4.44		1.09		2.43		3.00		3.54

The final table in the series shows the average moisture in each foot in depth of the several plots on each strip from June 4th to September 7th, inclusive. It is as follows:

AVERAGE PER CENT OF MOISTURE FOR THE SEASON.

East strip.

	1st foot.	2nd foot.	3rd foot.	Av. for three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Plot 1, no cultivation	6.16	4.70	6.66	5.84
Plot 2, frequent cultivation, 3 in.	7.15	5.72	8.23	7.03
Plot 3, frequent cultivation, 5 in.	7.45	5.98	7.83	7.09
Plot 4, ordinary cultivation	6.28	5.64	8.44	6.79

West strip.

	1st foot.	2nd foot.	3rd foot.	Av. for three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Plot 1, no cultivation	7.16	6.36	11.73	8.42
Plot 2, frequent cultivation, 3 in.	8.41	6.81	12.74	9.35
Plot 3, frequent cultivation, 5 in.	8.75	7.36	12.10	9.40
Plot 4, ordinary cultivation	7.74	8.26	11.41	9.14

It is evident from the table giving the average moisture during the growth of the corn that Plot 3 in the east strip has the largest amount of moisture of any in that series. Plot 2 is next with but a slight decrease; Plot 4 is next and Plot 1 has the smallest amount of any. The same table shows us that in the west strip the relative amounts of moisture stand in exactly the same order. The variation in moisture is nearly the same in both series. The evidence in favor of frequent cultivation for preserving moisture is very strong, inasmuch as the duplicate trials agree perfectly and the results are in exact accord with those secured in the experiments of 1897.

The difference in moisture between plots cultivated 5 inches deep and those cultivated shallow is small, but the results on one strip confirm those on the other, both as to the total amount of water present during the season as a whole and as to the variation in water content from period to period. The table shows that the average moisture for the first and second foot of Plot 3 is invariably larger than for similar depths in Plot 2. It also shows that in the third foot of plot 3 there is less moisture than in the corresponding foot of Plot 2. Throughout the dryest part of the season, after July 5th, there was continuously more moisture in Plot 3, in both strips than in any other plot. The moisture in the upper foot of the soil is manifestly larger on every date when a sample was taken, in Plot 3, than in the other plots. There are single exceptions, but as a rule the statement is true. In the second foot after July 5th there is again more moisture in Plot 3, cultivated five inches deep, than in the other plots. The results vary as to the amount of moisture in the third foot. On the east strip the third foot in depth seems to be more wet in Plot 2, cultivated three inches deep, than in Plot 3, where the cultivation was five inches deep. On the west strip the third foot in depth contains more moisture in Plot 3, cultivated five inches deep, than in Plot 2, except on the dates July 5th and August 23rd. The relative moisture content of Plots 2 and 3 is not materially different.

Prof. King has secured results similar to these in plots cultivated one and one-half and three inches deep. On pages 279 and 280 of the Wisconsin Report for 1894, the results of twelve determinations to a depth of four feet are given. In the third plot five determinations out of twelve show more moisture in the shallow than in the deep cultivated plot and in the fourth foot six out of the twelve show the same thing. In only one instance in the first foot in depth is there more moisture in the plot cultivated shallow than in the one deeply tilled. In the second foot there is not a single case of this kind. The total evidence in these experiments is largely in favor of the deep cultivation. It must not be concluded that, because cultivation to a depth of five inches secures more moisture, that five inches is the depth to be pre ferred for corn. The discussion of this point must be reserved until the yields of corn from the different plots are examined.

In connection with the effect of deep cultivation on the distribution of soil moisture, the effect of frequent and infrequent cultivation should be noted. In the east strip the third foot in Plot 4, infrequently cultivated, has more moisture than any other plot at the corresponding depth. Plot 4 of the west strip has more moisture in the second foot than any other plot at the corresponding depth. And the average of the second and third feet for Plot 4 on each strip is higher than that of any other plot of the same strip. The average moisture for two feet below the first foot is as follows:

	Plot 1.	Plot 2.	Plot 3.	Plot 4.
	Per cent.	Per cent.	Per cent.	Per cent.
East strip	5.68	6.97	6.90	7.04
West strip	9.04	9.77	9.73	9.83

The difference in moisture as indicated by these figures is small, it is true, but each of these amounts is the average of fifty-six samples. This fact and the farther one that the duplicates agree exactly indicates that the results are not a matter of chance.

We believe that they go far toward confirming the following propositions:

First, thorough and frequent cultivation conserves moisture and increases the total amount available for the crop.

Second, such cultivation concentrates the moisture near the surface, where it is more readily secured by the plants.

The growth of corn on adjacent strips on soil differing in fineness, the other conditions being the same, gives an opportunity for determining something as to the amount of water the crop was able to secure from the two kinds of soil. Approaching the subject from the other side, the following short table shows the decrease in moisture per square foot of horizontal area to a depth of three feet. In the first column of the table is given the pounds of water at the beginning of the season in a section of soil a foot square in horizontal area and three feet deep; in the second and third columns the same facts for August 9th and September 7th, respectively, and in the fourth and fifth columns the decrease of moisture in pounds to the dates given:

	June 4.	Aug. 9.	Sept. 7.	Decrease.	
				To Aug. 9.	To Sept. 7.
	lbs.	lbs.	lbs.	lbs.	lbs.
East strip, lighter soil	29.27	11.27	13.	18.00	15.53
West strip, heavier soil	30.50	15.25	21.64	15.25	8.86

We have no means of determining the upward flow of water from below the depth of three feet, nor the amount of rain water utilized by the crop in each case. It will appear later that the yield on the heavier soil was less than on the lighter, confirming seemingly the indications of the above figures that the lighter soil actually supplied more moisture than the heavier, notwithstanding the larger water holding capacity of the latter. This is contrary to the usual belief and is worthy of mention.

THE YIELD OF CORN.

The corn was cut with a harvester September 10th and 12th, and immediately drawn to the barn, weighed and cut into a silo. Samples were taken before cutting for the determination of dry matter. The ends of all the rows and the side rows of each plot were rejected. The harvested portion was thus limited to three rows (in all eleven and one-quarter feet wide, and five hundred and ninety-five feet long). At the time of harvest no difference in the growth of the corn plots 2, 3 and 4 of either strip could be detected. It was all large and well eared. The corn on Plot 1 was from two and one-half to three feet high, having but few ears and these merely soft nubbins.

The yield per acre of green corn and of dry matter on the several plots is given in the next table.

	East strip.		West strip.	
	Green weight.	Dry matter.	Green weight.	Dry matter.
	bs.	lbs.	lbs.	lbs.
Plot 1, no cultivation	2,186	723	1,848	620
Plot 2, frequent and shallow	13,207	5,532	12,258	4,790
Plot 3, frequent and deep	12,687	4,799	12,700	4,728
Plot 4, infrequent and deep	12,167	4,380	10,514	3,849

In the east strip the yields of green fodder stand in the same order as the per cents of moisture noted in previous tables, except that Plots 2 and 3 are reversed. In the west strip, Plots 2 and 3 are not reversed. The green weight is not, however, the true indication of the returns of feeding value from the fields. What the farmer wants is not gross weight but feeding value, and this fact is determined by the pounds of dry matter yielded. Comparing then the yields of dry matter on the several plots, we find that the order for the east strip remains the same, while Plots 2 and 3 are reversed in the west strip, making the sequence of plots in order of greatest yield as follows: Frequent cultivation, 3 inches deep; frequent cultivation, 5 inches deep; ordinary cultivation, 5 inches deep, and no cultivation.

The per cents of dry matter in the yields of the different plots are as follows:

	Plot .	Plot 2.	Plot 3.	Plot 4.
	Per cent.	Per cent.	Per cent.	Per cent.
East strip	33.08	41.89	37.83	36.00
West strip	33.53	39.08	37.23	36.61

It is interesting to note that the per cents of dry matter stand in the same order as the yields. This fact goes to show that not only does proper cultivation give larger yields but the product is more valuable, pound for pound.

Experiments have shown almost conclusively that a thick mulch is more effective than a thin one in conserving moisture. That the deeply cultivated plots should have more moisture than the others was to be expected; but deep cultivation, especially after the corn roots are well developed, injures so many roots that it is not strange that the growth of the corn should be checked and the yield reduced. To decide how deep the cultivation may be to secure a good mulch and at the same time not injure the corn roots will require much experimentation. Out of twenty trials conducted by the Wisconsin Station (Wis. Report 1894, page 282) comparing cultivation one and one-half and three inches deep, fourteen favored three inches and five favored one and one-half inches. The average yield for the twenty trials in favor of three inches was 1.08 per cent. In the trials reported in this bulletin the average yield in favor of the three inch cultivation is 8.34 per cent.

On the plots cultivated three inches deep it was noted that, after the roots had developed, they occupied the soil to the lower limit of the mulch formed by the cultivators. The teeth could not have run deeper without destroying many roots. These facts seem to indicate that three inches is approximately the correct depth for corn cultivation. The character of the soil should be taken into consideration. On the east strip the difference in favor of the three inch cultivation was 15.27 per cent, while on the west strip where the soil was heavier, the difference was only 1.31 per cent.

Experiments at the Ohio Station do not confirm these results. There, on a gravelly soil, trials extending over two years gave an advantage of 7.64 per cent. in favor of shallow cultivation in yield of grain, while similar trials on a heavy clay soil gave 8.14 per cent. advantage for the same cultivation. Further investigation along this line is much needed.

A very important result of our experiment is the evidence it gives in favor of frequent cultivation. The frequent cultivation at a depth of three inches gave an increase of approximately 25 per cent. over infrequent cultivation. In the east strip there is an advantage in favor of frequent, deep cultivation of 9.6 per cent. In the west strip of 22.8 per cent. or an average of 16.2 per cent. of water in favor of the frequent deep over the infrequent deep cultivation. It is possible that the frequent cultivation late in the season did not contribute largely to this result. The point is undecided, but this much is true, that frequent cultivation did increase the yield to a very marked degree. It cannot fail to be of great importance to the farmer that frequent cultivation will not only keep his corn fields free from weeds but will bring an actual return in yield that will more than compensate him for the extra labor.

A word of explanation about the yield of the uncultivated plots is called for. Growth on these plots had practically ceased July 25th. After this date the corn simply dried up. When it was cut the stalks themselves were found to be green and watery and the proportion of dry matter was less than in the cultivated plots.

THE DRYING OUT OF THE GROUND DURING THE RIPENING OF WHEAT.

The observations were made in Field 6 growing a crop of Currill wheat, which was cut July 4th. Samples for the determination of moisture were taken on June 28th and again on July 5th, the day after the wheat was cut. In the following table there is set forth the results of these determinations:

	1st foot.	2nd foot.	3rd foot.
	Per cent.	Per cent.	Per cent.
June 28th	14.73	8.91	15.01
July 5th	10.19	8.85	11.41
	4.54	.06	3.60

The work was repeated on a plot in Field No. 3, sown to Dawson's Golden Chaff wheat and cut July 7th. The facts in that case are as follows:

	1st foot.	2nd foot.	3rd foot.
	Per cent.	Per cent.	Per cent.
June 29th	15.16	6.82	6.36
July 8th	10.35	7.60	7.18
	4.81	—.78	—.82

The wheat was moderately ripe in both cases when cut. There were two light showers between the time of taking the first and second samples, the rainfall amounting to .11 inches. There is in both cases a marked decrease in moisture during the ripening period. Comparing the amounts on the first date with those on the second, there is an average decrease of 16.27 per cent. Thish suggests that when the saving of moisture is important on account of a clover or timothy crop to follow, the wheat should be cut at the earliest possible moment. Afterwards the stubble may be clipped with a mower to form a protecting mulch. The drying out of the soil does not cease when the wheat is cut, as is shown by the following observations, made in Field 6 and Davenport plots Nos. 1, 7, 66 and 68:

Field 6.

	1st foot.	2nd foot.	3rd foot.
	Per cent.	Per cent,	Per cent.
July 5th	10.19	8.85	11.41
July 26th	4.03	10.90	10.47
	6.16	—2.05	.94
Davenport Plot 1.			
July 8th	10.35	7.60	7.18
July 26th	13.21	7.24	7.37
	—2.86	.36	—.19
Davenport Plot 7.			
July 8th	10.37	11.40	8.98
July 26th	8.39	5.90	9.10
	1.98	5.50	—.12
Davenport Plots 66 and 68, north end.			
July 12th	21.65	9.45	8.06
July 26th	13.58	9.06	8.24
	8.07	.39	—.18
Davenport Plots 66 and 68, south end, sandy.			
July 12th	9.79	6.66	3.56
July 26th	7.50	7.44	6.28
	2.29	—.78	—2.72

The Davenport plots 66 and 68 were tested separately and the figures given are the averages of the two samples. Where samples were taken from the north end of these plots the soil was mucky for the first foot in depth. The samples marked third foot were in reality but six inches in depth, making a total depth of but two and one-half feet instead of three feet. Except as indicated above the soil was a loam with a clay subsoil.

While these results are somewhat variable the average loss is quite marked, being 15.47 per cent, or more than one-seventh of the total moisture remaining in the ground after the wheat was harvested. The loss must have occurred through evaporation, as the clover upon the areas where the samples were taken had made very little growth before July 26th. To prevent this evaporation a mulch, even if no more than the stubble cut by a mower as before suggested, might be of a marked benefit to the seeding.

DRYING OUT OF SANDY SOIL BY CLOVER.

On July 15th, 1897, an unmown clover plot was plowed for green manure. Five days later the following amounts of moisture were found on this plot and on an adjoining plot that had to that late date lain fallow:

	1st foot.	2nd foot.	rd foot.	Average three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
No crop	9.30	7.59	7.55	8.15
Clover	9.89	2.75	2.67	5.10
	—.59	4.84	4.88	3.05

There was 62.5 per cent more moisture in the soil of the plot that had borne no crop than in the plot that had borne the clover.

In taking samples on the clover plot, a layer of dry sand about a foot thick was found. The upper limit of this dry sand was fourteen to sixteen inches below the surface. It contained but 1.12 per cent of moisture. Its presence in the second and third foot explains the very low per cent of moisture at these depths.

LENGTH OF TIME REQUIRED FOR A HEAVY RAIN TO SOAK INTO A DRY SOIL.

On the 21st or July 1.22 inches of rain fell. This was followed on July 26th by the very unusual rainfall of 4.34 inches. After these rains the following observations were made on the clover plots before mentioned:

	1st foot.	2nd foot.	3rd foot.	Average three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
July 26th	16.76	10.55	4.60	10.64
July 27th	12.91	8.08	8.51	9.83
July 28th	12.52	7.68	8.01	9.40
July 31st	9.51	6.78	7.03	7.74

On July 26th there was still a layer of dry soil in the third foot. On the 27th this had disappeared and the moisture was more evenly distributed through the three feet. It was not until July 31 that the moisture became normally distributed. This gives an idea of the length of time required for the flow of water in an open sandy soil to the dryer parts. In a less porous soil the time required is much greater, as is shown by the following observations:

An opportunity was afforded in Field 6 on the two strips of corn ground, the behavior of which has been described in the previous pages of this bulletin, to determine the apparent rate and extent of the downward movement of water after rain. Samples were taken September 12th, October 1st and October 22d. As shown in the table of rainfall on page 86, this weather was wet almost continuously after the 1st of October, and on this account the evaporation from the surface was slight. The following table shows the per cents of moisture in the two strips to a depth of three feet on the dates given:

	East strip.				West strip.			
	1st foot.	2nd foot.	3rd foot.	Average three feet.	1st foot.	2nd foot.	3rd foot.	Average three feet.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Sept. 12th	4.66	4.19	5.47	4.77	5.56	5.39	9.49	6.81
Oct. 1st	8.22	4.41	3.07	5.23	9.28	8.53	8.66	8.82
Oct. 22nd	12.66	7.25	4.92	8.28				

These figures show first that the 2.03 inches of rain that fell between September 12th and October 1st made no increase in the moisture whatever below the second foot and in the east strip very little below the first. In the third foot, on the other hand, there is actually a decrease. This is difficult to explain, but the statement is true in five out of the eight individual plots examined. See table of moisture determinations for the season, page 183.

In the second place, the table shows that the 2.43 inches of rain between October 1st and October 22d made a marked increase in the first and second feet, but in the third the increase was so slight that the moisture on October 22d was not as high as on September 12th. We have here an instance of 4.46 inches of water added to the soil in the course of five weeks, and yet no increase of the moisture in the third foot.

A COMPARISON IN APRIL OF THE MOISTURE CONTENT OF FALL PLOWED AND UNPLOWED LAND.

This test was made in Field No. 8, in corn the year previous and partly plowed in the fall. Samples were taken on both the unplowed and fall plowed areas on April 11th, 15th and 18th. The average per cent of moisture in these samples for the two areas is here recorded:

	1st foot.	2nd foot.	3rd foot.	Average three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Unplowed	17.61	15.58	15.38	16.19
Fall plowed	16.14	14.93	15.83	15.64
	1.47	.65	—.45	.55

In Field No. 6.—Fall plowed grew sugar beets and the unplowed mangels in 1897.)

Unplowed	11.33	8.95	10.64	10.31
Fall plowed	11.37	8.13	10.33	9.94
	—.04	.82	.31	.37

The balance is unquestionably in favor or the unplowed land under the conditions existing in our experiments during the early spring.

Results secured later in the season show the opposite to be true for the late spring. On the 6th and 17th of May, samples were taken on ground which had grown oats the previous year, one area of which was fall plowed and another left unplowed, with the following average results:

	1st foot.	2nd foot.	3rd foot.	Average three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Unplowed	10.51	7.09	8.71	8.77
Fall plowed	10.56	7.62	8.59	8.92
	—.05	—.53	.12	—.15

Here there is a difference in favor of the fall plowed. The stirred soil has acted as a mulch to retard evaporation, hence the change.

The moisture determinations by dates in the oat plots in No. 8 also show a larger per cent. in moisture in the fall plowed land as the season progresses as follows:

AVERAGE MOISTURE IN OAT PLOTS, NO. 8.

	April 30.		May 13.		May 31.		June 7.	
	Fall.	Spring.	Fall.	Spring.	Fall.	Spring.	Fall.	Spring.
	Percent	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.	Percent.
Not rolled	----------	17.67	15.17	16.65	15.22	14.71	13.08	11.43
Rolled and harrowed	14.74	15.64	15.46	17.43	16.09	13.65	12.33	10 58
Rolled and drilled	19.40	15.95	14.98	15.67	15.87	13.61	12.13	19.92
Drilled and rolled	16.70	15.98	15.33	14.26	17.49	15.02	12.45	10.60
Average	16.95	16.31	15.23	16.00	16.17	14.25	12.50	10.63

In the above table the average for the fall plowed for the first two dates in 16.09 per cent, and, for the spring plowed 16.15 per cent, or practically the same. For the last two dates the average for the fall prowed is 14.33 per cent, and for the spring plowed 12.44 per cent. Here is a marked difference in favor of the fall plowed land, a difference evidently much greater after the middle of May than before.

In the Wisconsin Report of 1891, on page 102, a record is made of two determinations of moisture on fall plowed clover sod and unplowed corn ground. Samples were taken May 14th and an average difference of .77 per cent of moisture to a depth of three feet was found in favor of the fall plowed land. Prof. King, who tried the experiment, says that the fall plowing was done very late and on clover sod. On these accounts the rain had not had the chance to establish good capillary connections with the undisturbed soil, and hence it was acting as a much better mulch than stubble ground would have made, or than the same ground had it been plowed earlier in the season so that the fall rains could have helped join the two together.

EFFECT OF EARLY PLOWING ON THE RETENTION OF SOIL MOISTURE.

Two tests were made of this question in Field No. 6. The plowing was done May 2d. Samples were taken for determination of moisture on May 10th and 17th, with the following results:

May 10th.	1st foot.	2nd foot.	3rd foot.	Average three feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Spring plowed	10.50	10.07	8.04	9.54
Not plowed	10.10	8.12	7.26	8.49
	.40	1.95	.78	1.05
May 17th.				
Spring plowed	9.33	6.75	6.97	7.68
Not plowed	8.78	5.92	6.82	7.17
	.55	.83	.15	.51

This gives a difference in the first instance of 2.8 pounds per square foot to a depth of three feet and of 1.4 pounds in the second instance, in favor of the land plowed early in the spring.

Experiments tried by Prof. King and reported in the Wisconsin Report for 1891, pages 101 and 102, show larger differences. The plowing was done April 29th and samples taken May 6th showing a difference for the upper three feet of 7.02 pounds of water per square foot. On another plot the observed difference of the samples taken May 14th to the same depth was 4.65 pounds.

These determinations all show that to have as large a supply of moisture as possible for the crop it is necessary to plow or work the soil in some way to form a mulch to prevent evaporation as early in the spring as the condition of the land will allow.

DRAFT OF FARM IMPLEMENTS.

BY M. W. FULTON.

Bulletin 165—Farm Department.

These tests began in 1895. A self recording dynamometer made by Aultman, Miller & Co., of Akron, Ohio, was used. All tests were of one minute duration and the distance traveled varied little in the different trials. The average draft for each trial was determined from the curve made by the recording pencil, by a planimeter, which gave the average height of the curve above the base line.

DRAFT OF WIDE AND NARROW TIRES.

Two wagons were used in these trials. The tires of one were one and five-eighths inches wide, of the other four inches. The diameter of the wheels was the same for both wagons. The front wheels were forty inches high and the hind wheels four feet. A uniform load, including wagon, of four thousand five hundred pounds was adopted.

The first trial was made on a gravel road, firm and dry. The draft of the narrow tire was 151 pounds and of the wide tire 141 pounds, a difference of ten pounds in favor of the wide tires. This agrees with the Missouri experiments which will be referred to later in the bulletin, but is directly opposed to the popular opinion.

Next on a sandy road, upon which the soft sand two inches deep rested upon a subsurface not smooth nor hard, the draft of a wagon with narrow tires was 263 pounds, with wide tires 217 pounds, a difference of 46 pounds in favor of the wide tires. It so happens unfortunately that there are several miles of road of this sandy character in the State and it is interesting to note that where the gross weight of the wagon and load is 4,500 pounds it is drawn more easily upon wide tires than upon narrow ones.

The next trial to be reported took place upon a stiff June grass sod about the middle of October, with, of course, the same load as in all other trials, viz., 4,500 pounds including wagon. Upon the sod, the draft of the wagon with narrow tires was 334 pounds, that of the wagon with wide tires, 256 pounds, a difference of 78 pounds, or 23.35 per cent, in favor of the wide tires. The next day upon a clover and timothy sod the narrow tires cut in two inches deep under the heavy load and the draft of the wagon was 590 pounds, while the wagon with the wide tires cut in but one inch and the pull was but 430 pounds, 160 pounds, or 27.11 per cent. less than the power required to draw the narrow tires.

On the same day a trial was made on corn stubble, driving between the rows. The narrow tires sank in two and one-half inches, requiring a pull of 731 pounds to move them; the same load upon the wide tires moved at a pull of 491 pounds, sinking in but one inch. Here was a difference in draft of 240 pounds, or 32.83 per cent—almost one-third less than with the narrow tires.

These results all favor to a very marked degree, the wide tires. While upon the gravel road, hard, smooth and well packed, the difference in draft is but 6.62 per cent, using the narrow tire as a basis, upon sod or raw ground the difference is so marked as to be decisive.

The Missouri Station has conducted elaborate trials, comparing wide and narrow tires, using a self-recording dynamometer as in our tests and with a net load of 2,000 pounds. The wide tires were six inches wide and the narrow ones one and one-half inches. The following is a partial summary of their conclusions. (Missouri Bulletin 139, page 165.)

"I. On Macadam street, as an average of the two trials made, a load of 2,518 pounds could have been hauled on the broad tires with the same draft that a load of 2,000 pounds required on the narrow tires.

"II. Gravel road. In all conditions of the gravel road, except when wet and sloppy on top, the draft of the broad tired wagon was very much less than that of the narrow tired wagon. Averaging the six trials, a load of 2,482 pounds could be hauled on the broad tires with the same draft required for 2,000 pounds on the narrow tires.

" * * * * * * * * * * Summing up all the tests on dirt roads, it appears that there are but three conditions on which the broad tires draw heavier than the narrow tires, viz.: (1) when the road is sloppy, muddy or sticky on the surface and firm or hard underneath; (2) when the surface is covered with a very deep, loose dust and hard underneath; (3) when the mud is very deep and so sticky that it adheres to the wheels on both kinds of wagons. It appears that the dust must be extraordinarily deep to show a higher draft for the broad than for the narrow tires. The three conditions just named, therefore, are somewhat unusual and of comparatively short duration. Through a majority of days in the year, and at times when the dirt roads are most used, and when their use is most imperative, the broad tired wagons pull materially lighter than the narrow tired wagons.

"IV. A large number of tests on meadows, pastures, stubble lands, corn ground, and plowed ground in every condition, from dry, hard and firm to very wet and soft, show without a single exception a large difference in draft in favor of the broad tires. This difference ranged from 17 to 120 per cent.

"V. It appears that six inches is the best width of tire for a combination farm and road wagon and that both axles should be the same length, so that the front and hind wheels run in the same track."

It is not within the purpose of this bulletin to speak at lenght of the effect of the habitual use, upon the one hand, of broad tires and on the other narrow ones, on the ordinary dirt roads of the country. The point cannot be passed, however, without calling attention to the fact that the deep ruts common to sections where narrow tires alone are used, are rare or entirely wanting in those sections where broad tires prevail.

INFLUENCE OF THE POSITION OF THE LOAD ON THE WAGON UPON THE DRAFT.

On October 19, a comparison was made between the draft of the wagon when the load was equally distributed upon all four wheels and the draft of the same wagon when the load was piled over the rear axle. Two trials were made in each case. The draft of the wagon when the load was equally distributed was 149 pounds, when almost entirely upon the hind wheels, 147 pounds, practically the same. These trials were made on a hard gravel road. A few days later upon a June grass sod the average of two trials in each case shows that with the load distributed the draft was 167 pounds, with the load on the front wheels, 294 pounds, upon the rear wheels, 289 pounds. These results seem to show that where the road is firm and smooth it is immaterial whether the load is evenly distributed over the four wheels or not, but where the ground is soft the draft is increased if the weight is very largely upon the front or hind wheels.

THE INFLUENCE OF POINT OF ATTACHMENT OF THE POWER UPON THE DRAFT.

These tests were made upon a gravel road in the first case level, and, in the second, with a grade of six feet to the hundred. In the first case where the dynamometer was attached in such a way as to bring the whiffletrees in a normal position the draft was 188 pounds; when the power was applied at the end of the tongue, nine and one-half feet ahead of the ordinary point of attachment, the draft was 174 pounds. Where the load was drawn up the grade mentioned, when the whiffletrees were in the ordinary position the draft was, as the average of two trials, 366 pounds; when the horses were hitched to the end of the tongue as before the draft was 379 pounds. These trials do not show a marked difference in draft which can be attributed to the difference in point or method of attachment.

HOW MUCH DOES GREASING THE AXLES REDUCE THE DRAFT?

Two trials were made to determine the draft of a wagon on the level gravel road with the stated load. The draft on the average was 188 pounds. The wheels were then removed, the grease wiped from the skeins and boxes of the wheels and a little grit added. The wagon was then drawn over the course three times showing an average draft of 230 pounds, an increase of 42 pounds, or 22.34 per cent.

DRAFT OF SUBSOILERS.

Late in the fall of 1896 a test was made of the draft of two forms of subsoil plows. In one case the loosening of the subsoil was accomplished by forcing through it a flat tongue-shaped piece of steel. In the other curved teeth stir up the subsoil. Three teeth were used, each approximately an inch in width and so curved as to dig to a considerable depth below the bottom of the furrow left by the ordinary plow. Subsoiler No. 1 was provided with a wheel which maintained a uniform depth; No. 2, with the curved teeth, and no appliance for regulating the depth, and in practice it was found impossible to keep it from gouging in deep in the softer places and running somewhat shallower than desired in others.

The average draft on four trials of each subsoiler at an average depth of ten inches below the bottom of the furrow left by the ordinary plow was for No. 1, 504 pounds and for No. 2, 606 pounds. To draw a subsoil plow is, therefore, very heavy work for a team.

THE DRAFT OF SPRING TOOTH HARROWS.

A test, comparative in its nature, was made with a floating spring tooth harrow having fifteen teeth and a riding spring tooth harrow with seventeen teeth. The latter covered a width of five feet and nine inches between the outside teeth; the float harrow was a little narrower. The test was made on a freshly plowed sandy loam, the depth three inches. With the driver riding, the draft of the wheel harrow, average of four trials, was 513 pounds; with the driver walking the draft was 346 pounds as the average of four trials. The draft of the floating harrow under the same conditions was 402 pounds.

On an unplowed compact loam, harrowing to a depth of four inches, two trials gave an average draft of 570 pounds with the driver on the seat and 513 pounds as the average with the driver walking. Under the same conditions the average of two trials with the floating harrow was 608 pounds. These tests go to show that the weight of the driver adds very materially to the draft on loose soil, but makes less difference on compact ground. They show also that the wheel harrow, the driver walking, does its work with less draft than the float harrow, the gain being much more appreciable upon compact than upon loose soil.

It is fair to presume that the draft of these harrows is approximately the same as that of harrows in general. It is no wonder that exerting such a continuous and heavy force in addition to the labor of traveling over soft ground makes harrowing one of the hardest jobs for a team on the farm. In the test of wagons with a gross load of 4,500 pounds, in only a few cases did the draft exceed the average of the harrow test. In plowing to a depth of six inches the draft rarely exceeded 350 pounds and the average is probably below 300 pounds.

The modern harrows pulverize the soil very completely and as a consequence must draw hard. They are suited rather for three or even four horses than for two.

THE DRAFT OF MOWERS.

On the 7th of July a test of the draft of two five-foot cut mowers was made in a field of clover and timothy where the yield of hay was approximately two tons per acre. The machines were unlike in the mechanism adopted to drive the cutter bar. Both machines were new at the beginning of the season and had had practically the same usage previous to the test. The knives were sharp. Each machine was given three trials with the following averages: No. 1, 244 pounds and No. 2, 246 pounds. These figures show about the draft required by a five-foot cut mower on reasonably level ground, in medium heavy grass.

A GRADE DAIRY HERD.

BY CLINTON D. SMITH.

Bulletin 166.—Farm Department.

The usefulness of the Babcock test and scales in selecting from a herd the cows which are turning little or no profits to the owner has been often demonstrated. When, however, a dairyman finds it necessary to purchase in a limited time a herd of twenty-five or thirty grade dairy cows, he can scarcely expect to use these modern appliances. No farmer is willing to sell his best cow, and could the buyer weigh her milk and test it for a week's time it would be no advantage to him, because the owner, having his estimate of the value of his cow confirmed, would refuse to sell her. Often the buyer has not sufficient time to make tests of milk of the cows he buys. As he drives from farm to farm making his purchases he must depend upon the lessons derived from his experience and study to teach him to judge, by the form and handling of a cow, her ability in the dairy.

In bulletins 127 and 149, and in several annual reports of the Station, the records of many cows in the herd of pure breds at the College are given. It has been our good fortune to develop Holsteins and Jerseys that have given enormous yields of milk and butter with relatively small expenditure of food. The lessons to be drawn both from the extraordinary yields and their small cost were not impressed upon the dairy community because it was believed that the chief factor in them was the breed of the cow. It was thought that the success of the Station in this line of work was to be attributed very largely, if not wholly, to the excellence of the foundation stock. To test the efficacy of good feed and continuous good care on the development of dairy cows and to test further the question whether a grade dairy herd should be kept at a profit under conditions existing in central Michigan, the State Board having the Experiment Station in control decided to purchase a herd of thirty grade cows, to erect for their shelter a barn of sufficient size and to feed and care for them as a prudent and economical dairy farmer would do.

The College had no special facilities for buying cows. Enquiry was made by letter as to the price of cows in different localities and as to their breeding as well. Visits were made to those sections where it was reported that good grade Shorthorn cows were to be had, livery rigs were hired and a canvass made of the territory from farm to farm, following the ordinary methods of the stock buyer. In no community visited were cows found to be either plenty or low in price. To secure the number determined upon it was found necessary to buy nearly every cow offered. Nine cows were purchased in the vicinity of Delhi Mills and Dexter, in Washtenaw county, seven were bought near Bay City and thirteen in Ingham and adjoining counties. Although the breeding of few of the cows could be ascertained it was evident from their appearance that most of them had a strong infusion of Shorthorn blood in their veins. The cows designated as Nos. 86 and 97 show some Jersey blood, while Nos. 87 and 104 evidently trace to some Holstein ancestor. Twenty-one cows were bought between August 25th and September 30th, 1897, seven were delivered at the College October 6th, and one cow was received as late as October 20th.

The herd was housed in a dairy barn built for the purpose and described on page 116, of Bulletin 149. This barn was barely completed in the arrival of the herd and provided storage room for hay, grain and bedding only. The silage had to be hauled forty rods from the silos at another barn.

A regular herdsman was employed by the month, who fed and cared for the whole herd and milked part of the cows; students were employed to milk the remainder at a stated price of five cents per day per cow. The herdsman began October 1, 1897, and left us April 1, 1898. His wages were $31.00 per month. He kept an account of the time devoted to the herd, which varied from month to month, but averaged, during the fall and early winter, two-thirds of his time. Later it required his full time. After April 1, another herdsman was employed at a salary of $26.00 per month, devoting his whole time to the care of the herd.

A careful account has been kept with the herd, charging it with the cost of the cows, the traveling expenses incidental to their purchase, the freight to Lansing, the wages of the herdsman, the cost of milking, the feed and pasture, and the cost of making the butter. In the accounts given below the quantity of material as well as the price at the College is given, that the reader may estimate what the cost of keeping the cows a year would have been in his immediate locality. The earliest date at which the annual accounts with the herd could begin was October 1, 1897, hence the account given below is divided on that date, charging the herd with the net cost of the twenty-one cows purchased before that time, taking into consideration, as far as they are concerned, their cost delivered at the College and their feed between the time of their arrival and October 1, on the one hand, and the receipts from them on the other.

During the fall and the first few days of December the milk was creamed and churned and the products sold separate from the milk yielded by the herd of pure breds. After the first week of December, and until the first of May, the milk was used in common with other milk, either yielded by the pure bred herd or purchased, for instruction, in cheese and butter making, to the regular and special students. The herd was credited with the milk at the price paid the farmers. During the fall the skim milk was fed calves and pigs. A record was kept of the amount of grain purchased for this auxiliary stock, and when these calves and pigs were sold the herd was credited with the receipts. Since, during the winter, the milk was sold outright this method could not be continued. After May 1, the product was sold through two channels. A good share of the cream was sold at sixty cents per gallon to ice cream manufacturers. The remainder of the cream was churned into butter and sold at varying prices. A part of the skim milk during the summer of 1898 was fed to calves belonging to this herd. There was, however, a large surplus, amounting to 43,466 pounds, which was fed to other stock. It cannot be unjust to credit this amount of skim milk at fifteen cents per hundred, making $65.20. The amount of butter made during the summer was 1,335.36 pounds, for the making of which at three cents per pound the herd should be charged $40.06. The butter sold at twenty cents per pound in May, sixteen cents in June, twenty-one cents in August and in September at twenty-two cents.

With the explanations given, the following set of accounts will indicate the various transactions with the Grade Dairy Herd, for the year beginning October 1, 1897:

GRADE DAIRY HERD.

Date.	Dr.		Date.	Cr.	
Aug. 25	To 9 cows and calf, Delhi Mills	$353 00	Aug. 31	By 730.2 lbs. milk at 90c	$6 57
	freight on same	21 27			
	traveling expenses	9 82	Sept. 30	By 6,825, lbs. milk at 90c	61 43
27	3 cows bought at Lansing	120 00			
31	3 " " " "	105 00			
	care of cows 23 hours, 10c	2 30			
	156 lbs. bran, $12 00	94			
	156 lbs. rye, $8.00	62			
	9⅛ weeks' pasture, 25c	2 28			
Sept. 4	To 2 cows, bought at Lansing	82 00			
7	expenses tuberculin test	6 67			
18	1 cow bought at Lansing	45 00			
22	1 " " " "	40 00			
30	2 " " " "	55 00			
	milking, 5c per cow per day	14 57			
	74.5 lbs. hay, at $10.00	37			
	617 lbs. skim milk, at 20c	1 23			
	489 lbs. bran, at $12.00	2 93			
	489 lbs. rye, at $8.00	1 96			
	69.8 weeks' pasture, 25c	17 45		" balance	814 41
		$882 41			$882 41

Date.	Dr.		Date.	Cr.	
Oct. 1	To balance	$814 41	Oct. 16	By 150 lbs. veal, at $5.50	$8 25
6	7 cows at Bay City	250 00	31	110 lbs. butter, at 22c	24 20
	freight on same	17 00		135 lbs. butter, at 20c	27 00
	traveling expenses	9 60		28.5 lbs. milk, at 2c	57
13	16 pigs	35 00		13 gal. cream, at 60c	7 80
20	1 cow, at Lansing	38 00		13.66 gal. cream, at 80c	10 93
31	making 245 lbs. butter, 3c	7 35			
	care and milking	30 78			
	6,046 lbs. bran, at $9.50	28 71			
	1,795 lbs. corn meal, $15.00	13 46			
	1,000 lbs. oil meal, $18.50	9 25			
	6,640 lbs. hay, $5.00	16 60			
	3,685 lbs. sugar beets, $2.50	4 60			
	2,462 lbs. silage, $2.50	3 08			
	1,235 lbs. corn stalks, $2.00	1 24			
	960 lbs. green clover, $2.00	96			
	240 lbs. middlings, $10.50	1 26			
Nov. 30	To care and milking	37 40	Nov. 30	By 435.5 lbs butter, 22c	95 81
	making 435.5 lbs. butter 3c	13 07		136.7 lbs. cream, 10c	13 67
	7,960 lbs. sugar beets, $2.50	9 95		7 lbs. milk, 2c	14
	4,330 lbs. shredded fodder, $2.00	4 33			
	1,820 lbs. hay, $6.00	5 46			
	3.982 lbs. corn meal, $15.00	29 86			
	800 lbs. oil meal, $18.50	7 40			
Dec. 17	To milking to date, at 5c per cow per day	49 90	Dec. 31	By 281.5 lbs. butter, 22c	61 93
31	care of herd	20 72		5 lbs. butter, 24c	1 20
	making 286.5 lbs. butter, 3c	8 60		1 gal. cream, 80c	80
	4,700 lbs. hay, at $5.00	11 75		10,575 lbs. milk, $1.10	116 33
	2,570 lbs. roots, $2 50	3 21		239 lbs. veal, $5.00	11 95
	2,000 lbs. bran	11 00			
	1,500 lbs. oil meal, $18 50	13 87			
	5.487 lbs. stalks, $2.50	6 85			
	22,010 lbs. silage, $2.50	27 51			
	5,276 lbs. corn meal, $12 00	31 65			
	1,136 lbs. middlings, $12.00	6 81			
Jan. 31	To care of herd	31 00	Jan. 31	By 17,239 lbs. milk, at $1.20	206 87
	100 lbs. cotton seed meal	92		1,985 lbs. pork, at $3.50	69 47
	1,000 lbs. linseed meal	8 90		888 lbs. veal, at 4c	35 52
	24,260 lbs. silage, at $2.50	30 32		426 lbs. veal, at 4½c	19 17
	6,152 lbs. corn stalks, $2.50	7 69			
	11,350 lbs. beets, $2.50	14 18			
	5,665 lbs. hay, $5.00	14 16			
	819 lbs. corn, $12.00	4 91			
	819 lbs. middlings, $13.00	5 32			
	½ ton salt	5 00			
Feb. 4	To 5 pigs	16 00	Feb. 11	By 131 lbs. veal, at 5c	6 55
19	milking	34 40	28	15,358 lbs. milk, $1.20	184 29
28	care of herd	26 72			
	865 lbs. middlings, $14.00	6 05			
	865 lbs. corn meal, $16.00	6 92			
	7.110 lbs. bran, $14.00	49 77			
	100 lbs. oil meal, 89c	89			
	1,187 lbs. cotton meal, $19.20	11 40			
	21,475 lbs. silage, $2.50	26 84			
	3,125 lbs. stalks, $2 50	3 90			
	13,510 lbs. beets, $2.50	16 88			
	8,881 lbs. hay $5.00	22 20			
Mar. 31	To care and milking	44 75	Mar. 23	By 1,680 lbs. pork, $3.40	57 12
	22,810 lbs. silage, $2.50	28 51	27	1,140 lbs. beef (102) $2.75	31 35
	16,400 lbs. roots, $2 50	20 50		126 lbs. veal, 5c	6 30
	7,975 lbs. hay, $7.00	27 91	31	16,317 lbs. milk, 85c	138 69
	2,419 lbs. corn meal, $15.00	18 14			
	5,580 lbs. bran, $16.00	44 64			
	300 lbs. cotton meal, $19.20	2 88			
	350 lbs. middlings, $14.00	2 45			
	950 lbs. stalks, $2.50	1 18			
Apr. 14	To tuberculin test	12 12	Apr. 30	By 312 lbs. veal, 4c	12 48
30	care and milking	38 62		15,889 lbs. milk, 90c	143 00
	2,790 lbs. silage, $2.50	3 48			
	4,120 lbs. corn meal, $15.00	30 90			
	900 lbs. cotton meal, $19.40	8 73			
	11,015 lbs. bran, $13.20	72 70			
	7,380 lbs. hay, $5.00	18 45			
	2,230 lbs. beets, $2.50	2 78			
May 31	To care and milking	55 90	May 31	By 100 gals. cream at 60c	60 00
	3,469 lbs. hay, $5.00	8 67		524.9 lbs. butter, at 20c	104 98
	5,607 lbs. corn meal, $18.00	50 46			
	600 lbs. cotton seed meal, $19.40	5 82			
	108 weeks' pasture, 25c	27 00			

Date.	Dr.		Date.	Cr.	
June 30	To care and milking	$40 12	June 30	By 135 gals. cream at 60c.	$81 00
	115 5-7 weeks' pasture, 25c	28 93		418.8 lbs. butter at 16c.	67 01
	182 lbs. cotton seed meal	1 76			
July 3	To 45,780 lbs. hay at $6.00	137 34	July 31	By 245.93 gals. cream at 60c.	147 56
13	2,000 lbs. hay at $4.00	4 00			
31	119 3-7 weeks' pasture, 25c	29 86			
	2,400 lbs. corn meal, $17.00	20 40			
	281 lbs. cotton seed meal	2 72			
	care and milking	26 25			
Aug. 31	To care and milking	27 93	Aug. 31	By 103 gals. cream at 60c.	61 80
	119 4-7 weeks' pasture, 25c	29 89		220.25 lbs. butter at 21c.	46 25
	2,375 lbs. corn meal, $16.00	19 00			
	2,637 lbs. bran, $12.00	15 82			
	143 lbs. salt	1 43			
Sept.30	To care and milking	43 90	Sept.30	By 75 gals. cream at 60c.	45 00
	111 3-7 weeks' pasture, 25c	27 86		171.41 lbs. butter at 22c.	37 71
	8,039 lbs. bran, $12.00	48 23		2,320 lbs. beef at $3.10	71 92
	1,410 lbs. corn meal, $16.00	11 28		43,466 lbs. skim milk at 15c	65 20
	service of bull	25 00			
Oct. 1	To making 1335.36 lbs. butter	40 06	Oct. 1	By inventory as follows:	
				25 cows	960 00
				21 tons hay, $6.00	126 00
				4 tons bran	48 00
				6 calves. 2,053.5 lbs. 4c	82 14
	Net profit	277 58		1 calf	15 00
		$3,310 96			$3,310 96

This account may be summarized as follows:

THE GRADE HERD.

		Dr.
To 29 cows, average cost delivered at the college, $39.51		$1,145 69
care and milking the same		520 51
making and selling 2,302.5 lbs. butter at 3c		69 08
salt		6 43
green clover		96
105,807 lbs. silage		119 74
94,310 lbs. hay		266 54
42,427 lbs. bran		270 87
31,068 lbs. corn meal		236 98
57,705 lbs. beets		72 10
21,279 lbs. corn stalks		25 19
4,400 lbs. linseed meal		40 31
2,550 lbs. cotton seed meal		34 23
574 1-7 weeks' pasture		143 54
pigs	$51 00	
3,410 lbs. middlings	21 89	
		72 89
service of bull		25 00
		$3,050 05

	Cr.
By calves sold, 2,272 lbs.	$100 22
pigs sold, 3,665 lbs	126 59
butter, 2,302.5 lbs.	466 09
cream, 703.69 gallons	428 56
milk, 75,414.1 lbs.	789 89
skim milk, 43,466 lbs.	65 20
3 cows sold during the year, 3,460 lbs.	103 27
excess of receipts over expenses in September 1897	16 68
inventory	1,231 14
	$3,327 64

These accounts show the total receipts, exclusive of the inventory, of property on hand at the close of the year, to be $2,079.82, of which $1,684.54 came from the sale of milk and its products. The total expenditures, including the cost of the cows, was $3,050.06. Excluding the cost of the cows and of the hay and bran on hand at the close of the year, the net expenses of the herd amounted to $1,730.37. Taking out the cost of the pigs and the middlings which they ate, we have $1,657.48 as the cost of keeping, feeding and milking, or $57.15 per cow, on the basis of the twenty-nine animals constituting the original herd. The feed alone, including pasture, came to $1,042.89, or $35.96 per cow, leaving $21.19 per cow as the cost of care, milking and making butter.

The net profit from the year's transactions amounts to $277.58, as shown by the above accounts. This, however, does not, by any means, represent the total benefit to the farm. For several successive days the manure made in the barn was weighed, the average being 1,600 pounds per day. The floors of the stable and gutters are practically water tight, and there was little loss of fertility when the cows were in the stable.

Since a minimum amount of bedding was used the manure consisted almost entirely of the solid and liquid excrements of the cows. Its entire weight for the winter was approximately one hundred and fifty tons. After April 15th the cows ran in a pasture lot adjacent to the barn during the day, where a part of the manure at least was wasted, distributed over an area where it was not badly needed. It is safe, however, to estimate the total tonnage of manure hauled to the fields at two hundred tons. The cows were well fed and the manure could not fail to contain a high per cent of fertilizing material. No exact money value can, of course, be ascribed to it.

It should be said in concluding the discussion of this phase of the subject that the cost of care, milking and incidentals, $21.19 per sow, is unduly high. The chief factor in that amount is the milking. For various reasons, including the good of the herd itself, it was found necessary to milk in a short time both morning and night. This necessitated the employment of a larger number of milkers than was economical, and, since the milking was done largely by students who had to come from distant rooms and make a change of clothes for a short period of work, it increased the price per cow to five cents per day.

(98.)

NOTES ON INDIVIDUAL COWS.

It was inevitable that the method followed in purchasing should result in bringing into the herd some unprofitable cows. The herd had necessarily to be sifted by the performance of the cow her first year. It was part of the plan to record the yields of all the cows, and to dry off and sell for beef those that did not yield 6,000 pounds of milk and 300 pounds of butter in twelve months, and replace them by other purchases.

In the following table is recorded the number by which the cow is known, her purchase price, yield of milk, of fat, the estimated amount of butter, the number of weeks she was milked, the date of the birth of her calf, if it occurred after October 1, 1897, and finally her present value, as determined by the separate estimates of competent cattle men:

No.	Cost.	Milk yield, pounds.	Fat yield, pounds.	Estimated butter yield, pounds.	No. of weeks milked.	Date of birth of calf.	Present value.
18	$30 00	6,073.2	258.33	301.38	42		$35 00
39	25 00	7,309.9	266.85	311 32	46	March 29, 1898	30 00
86	40 00	5,687.7	244.36	285.08	52		30 00
87	35 00	10,309.9	344.14	401.49	44	December 20, 1897	50 00
88	32 00	6,762.1	250.57	292.33	44	April 3, 1898	37 00
89	40 00	6,639.0	251.90	293.88	48		35 00
90	40 00	9,135.5	291.84	340.48	46	April, 2, 1898	40 00
91	45 00	8,207.4	290.79	339.25	52		40 00
92	35 00	6,009.8	234.58	273.67	50		35 00
93	40 00	5,209.6	175.10	204.28	50		38 00
94	45 00	7,595.1	261.22	304.75	52		34 00
95	36 00	7,154.9	272.70	318.15	46	November 1, 1897	44 00
96	50 00	7,486.6	303.31	353.86	40	December 15, 1897	40 00
97	41 00	6,745.7	249.27	290.81	45	October 9, 1897	37 00
98	41 00	8,135.3	327.69	382.30	48	October 22, 1897	50 00
99	30 00	7,072.8	263.15	307.00	49		*
100	40 00	6,581.6	231.19	269.72	43	November 10, 1897	*
101	45 00	6,956.3	245.78	286.74	47	March 21, 1898	36 00
102	40 00	175.5	7.12	8.30	2		*
103	35 00	6,745.4	284.57	331.99	45	November 15, 1897	40 00
104	35 00	8,054.1	272.62	318.05	47	October 29, 1897	40 00
105	35 71	6,931.6	269.10	313.95	42	December 5, 1897	40 00
106	35 72	8,208.9	305.21	356.07	50	October 24, 1897	47 00
107	35 00	8,004.0	298.16	347.85	50	May 2, 1898	40 00
108	35 71	7,679.0	285.82	333.45	49	April 25, 1898	40 00
109	35 71	5,820 3	216.05	252.05	46		35 00
110	35 71	3,044.7	113.63	132.56	39		35 00
111	35 71	2,265.2	89.40	104.30	25		†
116	38 00	5,687.5	214.80	250.60	33	February 3, 1898	32 00

*Sold.
†Slaughtered.

Number 102 was severely injured in the udder soon after purchase. She recovered very slowly but was finally fattened and sold for beef. Number 111 was condemned as tuberculous in April, 1898, and slaughtered. Numbers 99 and 100 were fattened and sold toward the close of their milking period because they were deemed too old to keep longer. Numbers 86, 91 and 94 gave milk through the entire year. Numbers 39, 87, 88, 90, 94, 96, 98, 101, 103, 104, 106, 107, 108, were giving milk October 1, 1898. The remaining cows had for the most part, given milk through the previous winter and were dried off in August or September of 1898.

Number 110 gave bloody milk at frequent intervals which had to be thrown away, making her record incomplete.

In determining what cows to keep for the next year attention is first paid to the records. It is significant to note that all of the cows gave over six thousand pounds of milk in the twelve months except 86, 93, 109, 110 and 116, throwing out of course both 102 and 111, which were disposed of before they had been in milk long enough to make any record. As far as milk giving is concerned, the average of the herd, including all the cows mentioned in the previous sentence except 102 and 111, is 7,009 pounds.

Each mess of milk was weighed as it was milked, and the quantity of fat yielded by the cow per week determined, by saving in a bottle properly marked a small sample from each mess. A small quantity of potassium bichromate was put in the bottle at the beginning of the week, to keep the milk from souring during hot weather. Each cow had her bottle thus marked and prepared and at the end of the week the sample it contained was tested by the Babcock test and its per cent of fat determined. This bottle of milk unquestionably fairly represented in quality the average yield of the cow for the week. In a book properly ruled the weight of each mess of milk given by the cow was copied. These weights were added together at the close of the week, and the sum multiplied by the per cent of fat shown by the Babcock test, in the samples taken from the milk of the given cow during the week. The product shows the amount of fat yielded by the cow in the given week. Experience has demonstrated that it requires by the methods in use at the College on the average 257.15 pounds of fat to make, with the addition of the proper amount of salt and water, three hundred pounds of butter. A yield of 300 pounds of butter, or 257.15 pounds of fat, is a high average for a grade dairy herd over the breeding and feeding of which the owner has had control for many years. It is, therefore, a very high average for a herd hastily gathered in a season of the year

(87.)

when cows are scarce. Again rejecting the yields of 102 and 111, the average production of fat per cow for the twelve months was 259.91, equivalent to 304.89 pounds of butter.

The largest yield of milk was given by 87, viz., 10,310 lbs.; the next 90, with 9,135.5 lbs. to her credit; 91, 98, 104, 106 and 107 each gave over 8,000 pounds. In fat yield 87 again takes the lead, with 344.14 pounds to her credit in 44 weeks and the period of lactation not yet complete. Other cows giving over three hundred pounds of fat are 96, 98 and 106. With none of these cows was the period of lactation complete. Eleven cows out of the twenty-nine purchased, rejecting of course 102 and 111, gave less than 257.15 pounds of fat. On the other hand, number 87 gave more than fourteen pounds of butter per week both on the last week in January and the middle week of February, and 90 gave 14.74 pounds of butter in the second week of May. A fact still more significant is that 116 gave 12.7 pounds of fat the first full week of her milking period, and yet during the whole of that period, lasting thirty-three weeks, gave out 214.80 pounds. Although on the start she promised by her appearance, as well as by her yield for a single week, to be one of the best cows in the lot, she rapidly declined and was dried off at the end of the thirty-third week. She is another illustration of the danger of estimating the value of a cow from a week's test alone.

COWS GIVING LESS THAN 300 POUNDS OF BUTTER IN THE YEAR.

In her full milking period of sixty-three weeks number 18 gave 451.25 pounds of fat, number 39, 318.39 pounds and number 91, 321.87 pounds of fat, or 526.46 pounds, 371.45 pounds, and 375.51 pounds of butter respectively.

No reason is apparent why the herd of cows the history of which is given in this bulletin may not be supposed to fairly represent the average cows of southern Michigan, as far as their breeding and treatment prior to their coming to the College is concerned. If their yields have exceeded the average of the cows in the herds of Michigan dairymen, it is largely because the treatment accorded them has been uniformly good. They have not been pampered and overfed for part of the season and neglected for the remainder. They have had a reasonably warm, well ventilated barn to protect them from the storms of winter. They have had succulent food whenever removed from pasture, and when, by drouth, the fields have been made bare, some forage crop has been provided to tide them over to the winter feeding. The cows have not been chased, worried nor ill treated. The high average yield of the herd is to be attributed to the combination of these factors.

A DISCUSSION OF FARM DAIRY METHODS.

BY GORDON H. TRUE.

Bulletin 167.—Farm Department.

In a consideration of the different methods of separating cream from the milk of which it is a part, it is well to keep in mind the composition of milk. We speak of milk as being composed of water, butter fat and solids not fat. Cream consists of butter fat mixed with more or less milk. Skim milk, if the separation has been complete, consists of the water and the solids not fat of the milk. Butter fat is lighter than milk and the solids not fat are heavier, and when milk is allowed to stand there is a more or less complete separation of the lighter parts of the milk from the heavier, the butter fat coming to the top in the form of cream, while the heavier skim milk settles to the bottom. The butter fat exists in the milk in the form of minute globules varying in size from one thirty-thousandth to one ten-thousandth of an inch in diameter. The smaller the fat globules the larger the relative amount of surface when compared with the volume and the greater the resistance offered by the milk in comparison with their buoyancy. In other words, the larger the fat globules the more rapidly do they rise to the surface.

Other things being equal, the heavier the liquid in which these fat globules float the more rapidly and completely will the separation take place. In the case of milk, however, those conditions which make the skim milk heavier make it at the same time a thicker and more viscous fluid, so that with the increase in specific gravity tending to aid the separation there seems to be an increased thickness of the fluid tending to retard it. Thus it is that the composition of milk comes to have a practical bearing upon the problems of creaming.

CREAMING.

Shallow pans.—The method of creaming milk most commonly practiced is probably that in which the fresh milk is set in shallow tin or earthen vessels and allowed to stand at the temperature of the room until, by the action of gravity, the heavier parts of the milk find their way to the bottom of the vessel and the lighter parts come to the top in the form of cream. This method was practiced by our mothers and by our grandmothers for generations, and we speak of it nowadays as the old shallow pan method.

While it is undoubtedly true that very good butter has been made, and is still being made, from cream raised by this process, it has its disadvantages. On account of the relatively large amount of room required for setting the milk in shallow pans, it is hard to provide a place where suitable conditions can be maintained without considerable expense. It is clear that the milk should be set in a room where the atmosphere is always pure and the temperature is under control.

It is argued in favor of the shallow-pan system that it is inexpensive. This is in a sense true, but if the same conditions of temperature and purity of atmosphere necessary in the other methods were insisted upon where shallow pans are used this argument could no longer be brought forward.

Too often we find that a part of the kitchen, pantry or cellar is used as a milk room, and that the use of these rooms for the cooking of food or the storage of food and of vegetables makes them unfit places for the keeping of milk. A clean, sweet, well ventilated cellar makes an excellent place for setting milk, but the kitchen or pantry should never be used. Milk is peculiarly susceptible to bad odors, and really fine butter cannot be made from milk set in an impure atmosphere.

Because of the relatively large amount of surface exposed, the cream upon milk set in shallow pans is liable to become hard through excessive evaporation unless some means are taken to prevent it. The hard cream upon the pan becomes hard lumps in the churn and these lumps, not taking color with the rest, appear as white specks in the butter. We have found that in practice it is a good plan to cover the pan with a single thickness of cheese cloth.

Not only is it essential that the air of the milk room should be pure and sweet, but it is equally important that the temperature should be under control. The lower the temperature of the room in which the milk is set the less will be the loss of the butter fat in the skim milk. In setting milk in deep cans we desire a temperature as low as 40 degrees Fah. If we could have our milk rooms at this temperature the separation of the cream would be much more complete than when set at ordinary room temperatures.

The difference between the specific gravity of the cream and that of the milk is made greater by cooling. The lower the temperature to which the milk is cooled, and the more rapidly it is cooled to that temperature, the more readily does the separation of the milk and cream take place.

By the use of the separator the cream may be taken from the milk immediately after milking. If the cold deep setting method of separation is used, the milk may be skimmed as soon as the cream has all risen, which, under the best conditions, will be at the end of about twelve hours; but in the case of shallow pans the time of skimming must be regulated by the condition of the cream. This will vary under different surroundings. Cream must have a certain degree of thickness in order to be skimmed without too great a loss from the almost unavoidable mixing of the milk and the cream during skimming. Some prefer to wait until the milk is sour. Skimming at the end of either twelve, twenty-four or thirty-six hours generally makes a most convenient arrangement of the work, and we have found it most satisfactory, all things considered, to skim at the end of twenty-four hours. The loss of butter fat would perhaps be a trifle less if the milk were allowed to stand longer and the cream were to become thicker, but the quality of the latter would not be as good. Skimming the milk while the cream is yet sweet is to be especially recommended if the product of the dairy is small and the cream has to be saved for some days in order to get a churning.

At best, the loss of butter fat in the skim milk from shallow pans is excessive. We have found that in the fall, when probably half of the cows in the herd were "strippers," and the milk was set for twenty-four hours in a room which varied in temperature from 57 to 62 degrees Fah., with an average between 58 and 59 degrees Fah., the butter fat in the skim milk was .66 per cent. A similar trial conducted for twenty-one days in the spring showed the same result. Here was a loss of practically one-fifth of all the butter fat. Excessive as this may seem, it is considerably below the average waste on farms where this method of setting milk is practiced. The average per cent of butter fat in the skim milk from shallow pans on seventeen farms near the college was found to be just a trifle under 1 per cent (.98 per cent). In seven cases it was above this figure, averaging 1.5 per cent, while in the ten cases where the loss was less than 1 per cent the average was .63 per cent.

Cold deep setting.—By cold deep setting is meant that system in common use where the milk is allowed to stand in some form of deep can set or submerged in cold water. The system has its advantages over the shallow-pan method. The tank of cold water with the enclosed cans of milk does not take up much room, thus making it easy to provide a place for it where the air is pure and the ventilation good. On account of the cans being covered, the cream is never hardened on the surface, as is liable to be the case with shallow-pan cream. It is not necessary for the milk to stand more than twenty-four hours, and, remaining as it does at a low temperature, both milk and cream are sweet at the time of skimming. The ripening of the cream may then be controlled, and the skim milk fed sweet to calves or pigs. Properly handled, there is less loss of fat in the skim milk than with shallow pans. The apparatus may consist simply of shot-gun cans set in kerosene barrels sawed off to be of proper depth, a conical dipper being used for skimming, or the more convenient and more efficient and at the same time more expensive cabinet creamer may be purchased. In either case, this method is preferable to setting in shallow pans.

Three prominent agencies are suggested as affecting the efficiency of creaming—the temperature of the water in which the milk is set, the temperature of the milk itself, dependent upon the time it has been milked, and the length of time that the cows have given milk. It might be added, too, that as cows differ individually, no two being just alike in every respect, so the milk of some cows creams more readily than that of others, the difference probably being due to the difference in the composition of the milk and the size of the fat globules.

In order to get the best results from cold deep setting, ice must be used. It is important that the milk be cooled as rapidly as possible; therefore, the colder the surrounding water, the better. We have recently made trials in which the milk of the herd, divided into separate lots and set in deep cans with the water at different temperatures, gave the following results;

	Temperatere degrees, Fah.	Average per-cent of fat in the skim milk
Milk set in water at	32-36	.19
Milk set in water at	40	.36
Milk set in water at	50	.84
Milk set in water at	58-60	.84
Milk set in running water at	58-60	.84
Milk set in open air at	62	1.40

These results point to the conclusion stated above, the colder the water the better. The statement is often made that water should be at least as low as 50 degrees, but our experience leads us to conclude that even 40 degrees is none too low.

Attention is called to the fact that the milk set in one case in standing water and in another in running water at the same temperature showed no difference in the efficiency of creaming. The idea seems to be prevalent that by setting milk in running water and thus keeping the temperature constant, better results can be obtained than by setting in still water at the same temperature, but this trial does not indicate tha such is the case. The temperature of the standing water rose on an average 7 degrees Fah., during the twenty-four hours that the milk was allowed to set.

It is to be observed, too, that the loss in the skim milk where milk is set in deep cans in the open air is excessive. It seems to be safe to conclude that unless water is to be used the shallow pans furnish a more efficient method of creaming than the deep setting.

While the best results seem to be obtained by setting milk as soon after milking as possible, the loss due to a slight delay in setting is not excessive if the water is at a low temperature when the milk is set. A certain amount of milk was divided into three equal lots, one of which was set immediately, one a half hour later, and the third half an hour later still, the water in all cases being at the same temperature and the milk never above 36 degrees Fah. The following are the results:

	Average per-cent of fat in skim milk.
Milk set immediately after milking	.216
Setting delayed half an hour	.25
Setting delayed one hour	.26

It is of the utmost importance that the water in which the milk is set be at temperature certainly below 50 degrees Fah., and preferably below 40, when the cans of milk are put in, otherwise an excessive loss of butter in the skim milk is to be expected. Setting the milk in water above 50 degrees Fah., and afterwards cooling the water down to forty or below will not prevent the loss. It is essential that the water be cold at the beginning.

The length of time the cow has been in milk has an influence upon the completeness of separation of the butter fat in the cream. The cream in milk from cows well advanced in the period of lactation seems to separate less readily than that in the milk of cows comparatively fresh. This difference is attributed to a decrease in the size of the fat globules in the milk, accompanied by an increase in the per cent of other milk solids, attendant upon the advance in the period of lactation. The smaller fat globules in a thicker fluid rise to the surface with greater difficulty.

In some half a dozen trials, in which the milk of a single fresh cow was set by itself, the skim milk showed the presence of only a trace of butter fat. At the same time there was in the herd another cow, in the eighteen month of her period of lactation, still giving a large flow of milk. Milk from this cow set under the same conditions in an equal number of trials showed a loss of over one per cent (1.08) of butter fat in the skim milk. When the milk of this cow was set as a part of the mixed milk of the herd, the can containing her milk showed an average loss in the skim milk of eight-tenths of one per cent (.8) of butter fat. By diluting her milk with ten per cent its weight of water, about the same loss (.81) was suffered as when mixed with the herd milk. When her milk was mixed with that of the fresh cow above mentioned the loss of butter fat in the skim milk was reduced to about a quarter of one per cent (.26).

In trials of the cold deep setting method conducted simultaneously with the trials of the shallow pans heretofore mentioned the following losses were obtained: In the fall trial, when the cows were all a long time in milk and the milk set for only twelve hours in water varying from 34 to 54 degrees Fah. in temperature averaging 45 degrees Fah., the loss was a little over seven-tenths per cent (.73). In the spring trial the milk set for twenty-four hours in water varying in temperature from 41 to 52 degrees Fah., averaging 45 degrees Fah., there was a loss of a trifle over four-tenths of one per cent (.41). From these results it appears that, under what may perhaps be called average conditions as regards temperature of water, setting milk for twenty-four hours gives much better results than setting for only twelve hours. It also appears that setting milk in shallow pans for twenty-four hours gives better results than setting in deep setting for twelve hours under the conditions existing in this experiment.

It should be added that in the above trials the average loss was somewhat increased by the skim milk being drawn off too closely in a few cases. Care should always be taken to leave a certain amount of milk with the cream, as the top layer of milk always contains some butter fat. Then, too, as milk runs off from below and the cream settles toward the bottom of the can unless the flow is checked the current of milk is liable to draw some of the cream out with it.

The separator.—The cream separator affords the most satisfactory means now in vogue for getting cream from milk. The machine consists of a very rapidly revolving bowl into which a continuous stream of whole milk runs and out of which continuous streams of cream and skim milk come. The rapid whirling of the milk serves to separate the heavier from the lighter parts, and just as the lighter cream finds its way to the top of the pan of milk when allowed to stand, while the heavier part of the milk settles to the bottom, so in the rapidly revolving separator bowl the cream finds its way to the outlet near the center of the bowl, the skim milk going to the outside. The operation is purely mechanical.

Among the advantages of the separator over the shallow pan and cold deep setting methods the following are to be considered: (1) The separation is practically complete, the loss in the skim milk being seldom more than one-tenth of one per cent, when the machine is properly handled; (2) The labor involved, it may be safely said, is less than in either of the other methods; (3) The milk is separated not only while sweet, but when warm, the cream is sweet and of even thickness, and the skim milk is in the best possible condition to feed to young stock as it comes from the separator; (4) Instead of having all the milk from the herd to keep cool, only the cream need be held at a low temperature, thus lessening the quantity of ice required; (5) The thickness of the cream may be regulated.

The main objection to the separator is the first cost. From the statements made in the foregoing pages concerning the loss of butter fat in the skim milk where gravity methods of separation are used, one who knows how much milk he gets during the year can readily calculate whether or not it will pay him to invest in a separator.

In the use of the separator three points should be carefully watched and regulated, viz.: the speed of the bowl, the temperature of the milk, and the feed of the milk to the machine. With the same machine and all other conditions the same, a greater loss of butter fat must be expected when the separator is not run up to speed, when the milk is below a certain temperature or when more than a certain amount of milk is run through in a given length of time.

With reference to the rate at which the separator should be turned, it is always safe to follow the directions given by the manufacturer for its operation.

The result of letting the speed get down was made clear by the following simple experiments: In the first case the power was removed from a machine running at full speed and full capacity, separating six hundred pounds of milk an hour, and the skim milk caught in small lots and tested separately. The following is the record of the test of the first seven quarts of milk coming from the machine after the power was removed:

	Per cent fat in skim milk.
1st quart	.03
2nd quart	.03
3rd quart	.045
4th quart	.05
5th quart	.10
6th quart	.12
7th quart	.16

In the second case a hand separator was turned at different rates of speed, forty-two turns of the crank per minute being recommended by the manufacturer. The following are the results:

	Per cent fat in skim milk.
45 turns per minute	.02
42 turns per minute	.04
39 turns per minute	.047
36 turns per minute	.05

In turning a separator by hand care should be taken to have the motion as steady as possible, the pressure of the hand upon the crank being the same all the way around.

For some weeks during the summer we creamed the night's and the morning's milk of the herd separately in the morning. The morning's milk, of course, was warm. The night's milk having been run over a Star Cooler immediately after milking and sometimes cooled even more by running cold water under the vat, was at a lower temperature. Separating at different temperatures gave the following results: The milk at an average of 87 degrees Fah. gave a loss of less than one twentieth of one per cent (.045 per cent), while at an average temperature of 66 degrees Fah. showed a loss of over one-tenth of one per cent (.105 per cent). If the separating is to be done after each milking, the sooner after milking the better; if but once a day, the lower temperature the better, on account of the subsequent handling of the cream.

Hand separators are usually so constructed that the feed of milk from the supply can will not exceed the capacity of the machine if it is run up to speed. If, for any reason, the machine is run below speed or the milk is below the desired temperature for separating, the feed should be cut down accordingly.

A trial was conducted covering some twenty-three days, in which a lot of milk each day was divided into three equal parts. One part set in shallow pans, one in cold deep setting and the third separated by means of a hand separator. The cream was kept and churned separately. The conditions under which the work was done were not ideal, and the losses were greater than we get in handling larger quantities of milk. Below are given the amounts of butter made by each method from 859 pounds of milk:

	Lbs. of Butter.
Shallow pans	33.84
Deep setting	33.04
Separator	36.74

While the difference between the amounts made from shallow pans and cold deep setting is slight, it was in this case in favor of the shallow pans, the deep setting milk being allowed to stand only twelve hours before skimming. It will be noted that the separator gave a saving of about three pounds of butter over the other methods.

The following spring Robert B. A. Buek, '96, under our supervision, conducted a similar trial as thesis work. In this case the milk of five cows in different stages of the period of lactation was taken for the experiment. There were seven days' trial of each method, and the days upon which the different methods were tried so alternated that the advance in the period of lactation should not affect the results. The amounts of milk used in the different trials not being the same, the results may be more easily compared if the amount of butter from a hundred pounds of milk be given:

	Lbs. of Butter from 100 lbs. of milk.
Shallow pans	4.6
Deep setting	4.9
Separator	5.5

The difference in favor of the deep setting over shallow pans is slight. The separator again shows a good gain over both the other methods. Nearly twenty per cent more butter was obtained by the separator than by either of the other methods.

Dilution method.—There have recently been put upon the market so-called cream separators, consisting simply of deep cans in which it is directed that the milk be mixed with a certain amount of water and allowed to stand from two to twenty-four hours, at the end of which time it is claimed that the cream will have separated completely from the milk. There is a faucet at the bottom of the can for drawing off the skim milk, and a strip of glass extending from the top to the bottom of the can allows the operator to see that the skim milk is all drawn off. The claims for efficiency in this apparatus are based upon the theory that by the addition of water to the milk the per cent of solids not fat, and therefore the viscosity of the milk is so reduced that, upon standing, the cream will separate itself completely from the rest of the mixture in a very short time. In a two weeks' trial of a can of this sort known as the "Wheeler Cream Separator," in which about forty pounds of milk were diluted with the same amount of water at sixty degrees, and allowed to stand for twenty-four hours, the average loss of butter fat was equivalent to seven-tenths of one per cent (.7) of undiluted skim milk. Not only was the loss excessive, but the skim milk thus diluted with so much water could not be fed to advantage, and the cream soured rapidly.

HANDLING CREAM.

Nothing contributes more to success in butter making than the proper care of cream. Creamery men are coming to understand this; too many dairymen do not. Proper care of cream alone will not give us good butter, but good butter cannot be made from cream not properly handled. Good cream cannot come from bad milk. The care of the milk, then, is most important, as the history of the cream begins with the history of the milk. The change in milk and cream which we call souring is due to the presence and the growth of minute organisms or germs, called bacteria. Any substance or thing which is perfectly free from all forms of germ life we can sterile.

Germs, however, find their way into the milk duct of the teat and, even though the bulk of the milk as it leaves the udder of the cow is free from germs, the first few draughts are loaded with them. If it were possible to avoid this contamination of the whole milk and to get the milk from the udder of the cow into sterile vessels without contact with the air, we would not be bothered with sour milk or cream. But, as it is, these minute forms of life are everywhere present. We cannot prevent their presence, so we must adapt ourselves to circumstances and control, in so far as we can, their growth. To properly care for cream is to handle it in such a way that this growth is controlled.

There are liable to be in the atmosphere of the barn different forms of germ life, each producing its characteristic result if it is allowed to develop in the milk or cream. There are numerous forms, the result of the growth of which is simply to sour the milk; others cause a slimy condition; some produce a gas which is especially troublesome to the cheese maker; some give a bitter taste to the milk; others form different pigments, imparting a blue or red color to the milk, as the case may be, and the presence of still others is made manifest by offensive odors. All of these forms do not thrive best under the same conditions. Some require high temperatures for their development; others require low; some require air; others do not. The form which finds itself in a majority usually develops itself at the expense of others, holding them in check if the conditions are favorable, by its own more rapid growth. The aim, then, in handling cream is to keep it under such conditions that the growth of all germs is held in check until we desire it to ripen, and then furnish the conditions most suitable for ripening. Fortunately the acid-producing forms of bacteria are usually most abundant in the surroundings of the dairy, and they develop rapidly under conditions easily afforded them.

Just here we would emphasize the necessity of the use of the thermometer in the dairy. Good work without it is impossible.

There are three reasons for ripening cream: it churns more readily, there is less loss of butter fat in the butter milk and a higher flavor is produced. The production of flavor is the most important end sought, and because of the relation of the ripening process to the flavor it is evident that the greatest care should be taken in this part of the work.

The same general principles apply to the ripening of cream, whether it be from shallow pans, cold deep settings or the separator.

The lower the temperature at which cream is kept previous to churning, the better, on general principles, will be the results, with reference not only to flavor but to body as well. The effect upon cream of standing for some time at a high temperature does not seem to be entirely overcome by any subsequent cooling.

The higher the temperature at which the cream is ripened, the more rapidly will the ripening take place. There is a wide difference of opinion as to what is the best temperature for ripening cream. Some butter makers ripen the cream at as low as 56 degrees Fah., while others use 75 degrees. In practice upon the farm neither extreme should be followed, and it will not be found best to invariably follow any fixed rule.

When one's sole business is not the making of butter and there are other things to attend to about the place, better results will, we think, be had by ripening at the lower temperatures, say 60 degrees Fah. in the summer and 65 degrees in the winter, except in the case of shallow-pan cream.

Under these conditions the cream ripens slowly, and there is not so much danger of its becoming over ripe. About twenty-four hours will be found necessary for ripening at these temperatures.

The use of higher temperatures, say 70 to 75 degrees Fah., is to be advocated in cases where cream is off flavor on account of being held, but the cream must be closely watched that too much acid is not developed.

In the case of cream from milk set in shallow pans, it is generally sour or partly so when skimmed and does not need much ripening. Indeed, our aim should be to keep it from getting over ripe. To do this the cream should be kept as cold as possible, best 50 degrees Fah., or below, until enough has been saved for a churning, being careful to stir it thoroughly every time a skimming is added. Do not add any fresh cream to the vats for at least twenty-four hours before churning. If, as will generally be the case, the cream is sufficiently ripe when a churning has been gathered, simply raise to the desired temperature and churn. If it is still sweet, warm it up to about 70 degrees, stirring it occasionally until it has developed a pleasant acid taste or smell—twelve hours will usually be sufficient. Then cool down to the churning temperature and churn, or, better yet, cool to 50 degrees Fah. again, and after allowing it to stand at that temperature for a time, raise to the desired temperature and churn.

The handling of cold deep setting cream and separator cream is practically the same except for the fact that the separator cream leaves the machine warm and should be first thoroughly cooled to a temperature as low as 50 degrees Fah. It is then in the same condition as cream from the cold deep setting, except that it is not so old and may therefore be held longer if necessary. In case either kind of cream is being handled it should be kept sweet until enough for a churning is gathered, and then ripened according to the general principles laid down above.

The starter.—The use of a starter in ripening cream is to be recommended. By a starter is meant sour milk, cream or butter milk, which is added to the cream to start the ripening, just as yeast is added to the dough to make bread rise.

If one is churning as often as every day or every other day, butter milk from the previous churning may be used with good results. If the cream for the last churning was not in the best condition the butter milk from it should not be used, as the fault will thereby be reproduced.

A most satisfactory starter may be made from skim milk—best the milk from a single fresh cow—by allowing it to stand at a temperature of about 85 degrees Fah. until it is loppered. Strain enough of it into the cream to produce the proper degrees of ripeness after standing, as suggested above, at 60 to 65 degrees Fah., for twenty-four to thirty-six hours.

Thirty-six hours is a convenient length of time to allow for ripening, as the cream may be set to ripen one morning and by the evening of the next day it may be cooled down and allowed to stand at a low temperature over night and then churned the next morning.

Perhaps it would be more proper to speak of this as allowing forty-eight hours for ripening, for the cream is certainly not ready for the churn at the end of the thirty-six hours; if it were it would be injured by standing over night, even at a low temperature.

The use of commercial starters in the home dairy is not to be recommended; not because their use would not give the best results, but because they are not needed.

We have used the commercial starters known upon the market as B. 41, Chr. Hansen's Lactic Ferment, and the Boston Butter Culture, all with good results, but their use has not given us any better butter than where the home-made starter was used.

During the winter of 1895-6 a number of trials were made in which two lots of cream were handled just alike except that in one case the B. 41 starter was used and in the other a home-made starter. Samples of the butter were sent to a Chicago commission man, who scored them without knowing their source. At the end of the trial it was found that the average scores for the different samples were practically the same.

The most accurate means for determining the acidity or ripeness of cream is furnished by what is known as the Mann's acid test, or by the use of Farrington's alkali tablets, a modification of the Mann's test. Both are simple and accurate, and their use to be strongly recommended.

One who has had a good deal of experience in ripening cream comes to judge its condition very accurately by its appearance. The question often arises how to tell by its appearance when cream is properly ripened, but it is difficult to describe. There is a slight thickening of the cream and it has an appearance of lightness which is contradicted by a feeling of heaviness as the dipper is drawn through the vat. There is a smoothness of appearance which unripened cream does not present.

Churning.—The churn which has no inside contrivance and in which the butter is made to come by the falling of the cream from one side to the other is the best churn. Countless churns of so-called improved patterns, with various styles of paddles or disks, have been put upon the market from time to time, usually with the claim that they would bring butter in some incredibly short time. We have used a number of these churns and found that, without exception, with the cream in the same condition, it has required just as much churning to bring the butter in them as with the barrel, box or swing churn, and very often the loss of the fat in the butter milk has been increased by the sticking of the cream to some central part of the inside affair.

The churn should never be filled more than half full of cream and less than half full is better. In order to test the influence of the fulness of the churn upon the time required to get butter, and upon the loss of butter fat in the skim milk, a number of churnings were made under the following conditions: Cream of uniform temperature and ripeness was divided into three lots of ten, twenty and thirty pounds each, and churned in churns made just half full by twenty pounds. The cream was well ripened and churned at an average temperature of 52 degrees Fah. The average time required to churn ten pounds of cream was thirty-four minutes; twenty pounds of cream, fifty-six minutes, and thirty pounds, sixty-four minutes. The per cent of fat lost in the butter milk was practically the same in each case.

Reference has been made several times to the churning temperature. In answer to the question as to what is the proper temperature for churning, it is well to say: "Churn at just as low a temperature as you can and have the butter come in a reasonable time." We find that a low temperature gives a more exhaustive churning than a high temperature, other things being equal. The butter is firmer and in smaller granules. Less washing is required to get the butter milk out of the butter and the salt may be more easily distributed. Thick shallow-pan or separator cream may be churned at a lower temperature than thin deep setting cream. The thicker the cream, so long as it will fall in the churn, the sooner the butter will come and the less will be the loss of the butter fat. Do not expect the butter to come in less than thirty minutes; better churn an hour and get a good, firm butter, with almost no loss in the butter milk, than have it come in ten minutes and be soft and the butter milk rich with the lost butter fat. The proper temperature will be found somewhere below 60 degrees Fah. Our practice is to churn at 50 degrees or below in summer and not above 56 degrees Fah. in winter.

Cream from the milk of fresh cows churns more readily than that from cows long in milk. It helps matters to dilute the cream from stripper's milk with water. Butter from some cows is naturally firmer than that from others, and the cream may therefore be churned at a higher temperature.

No hard and fast law can be laid down with reference to churning temperature. One must follow the rule given above in a general way and adapt himself to circumstances.

If the butter is to be colored, and butter from most cows requires some additional color, the coloring matter should be added to the cream when it is first put in the churn. Color to suit the market, using one of the standard commercial butter colors.

The churn should be turned at such a rate of speed as to produce the most concussion. A small churn may be turned faster than a large one, and one containing thin cream may be turned faster than one in which the cream is thick. By practice, one comes involuntarily to regulate his speed with the fall of the cream in the churn.

Churn until the butter appears in fine granules about the size of a kernel of wheat, floating well up out of the butter milk. Cold water may be added to the cream in the churn, just as it is breaking, with good results, especially if the butter is coming a little soft. If the granules form, but fail to float as they should, making it impossible to draw off the butter milk without having the butter come with it, add a little cold water; or, better, water in which salt has been dissolved, adding say a pint to a gallon of cream, generally brings the granules to the surface after only a few revolutions of the churn. *Never under any circumstances add warm water to cream in the churn.* If the churning has been carried to just the proper point the butter milk will draw off readily and but one washing of the butter will be necessary. If the churn has been stopped just a little too soon two washings may be required. Excessive washing of butter is liable to injure the flavor, and while the rule to wash until the water comes away clear is a good one to follow, on general principles, where butter is wanted for immediate consumption, a single washing will generally be more satisfactory. Clear, cold water or weak brine may be used. Fill the churn half full, turn two or three times and draw off the water immediately. It is best not to allow the butter to stand for any length of time in the wash water unless in an extreme case of soft butter, which would not occur if churned at the proper temperature. It is our aim to use wash water at about fifty degrees in the summer and at a higher temperature in the winter. If too cold water is used, the outside of the particles of butter becomes chilled while the inside remains soft, and the result is an uneven mixing of the salt when the butter is worked.

Butter may be salted in the churn, but there is the objection to it that always holds with reference to the once working of butter. The object of working is simply to distribute the salt thoroughly through the butter and expel the excess of moisture. An uneven distribution of the salt results in an uneven color, or what is commonly spoken of as mottled butter. Where butter is worked but once the operator is never sure that his butter will not be mottled. If salting in the churn is practiced, add the salt while the butter is in fine granules, and then revolve the churn until the particles adhere to one another but have not formed solid chunks; then, after allowing to stand for a couple of hours, or as long as the weather or the arrangement of the work will permit, continue the turning until the butter has come into such form as will be convenient for taking out and packing.

While it is usually preferable to work butter twice, care should be taken not to over work. Never work it until it fails to present a granular appearance when broken or pulled apart on the worker. As soon as the butter begins to hang together when it is broken off and little pin points of butter show at the break, it is time to stop working. Two or three hours should elapse between workings. It is generally more convenient to give it the second working on the following day.

Always use *dairy salt.* Care is taken in the manufacture of this salt that the granules are, to a certain extent at least, uniform in size. For this reason it dissolves more evenly in the butter. We at one time ran out of dairy salt, but happened to have on hand a number of packages of table salt of the manufacture we had been using. For a few days the table salt was used in the dairy, and during those days it seemed almost impossible to work the mottles out of the butter. We attributed the difficulty to the unevenness of the size of the salt granules. A part of the building in which a barrel and some bags of dairy salt were stored was fumigated by the burning of sulphur. Butter salted with this salt tasted of sulphur and was practically ruined.

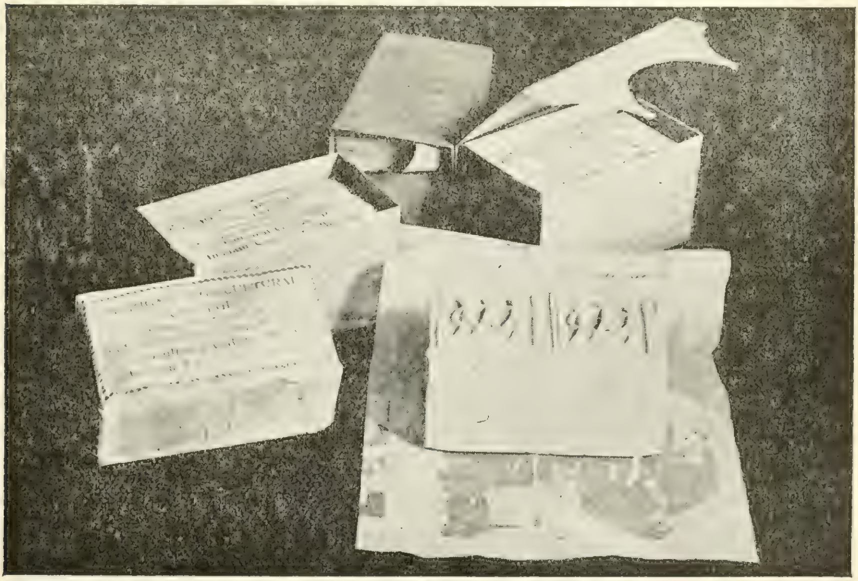
PACKING AND PRINTING.

The method of packing and printing butter must be determined very largely by the trade one is seeking to satisfy. If private customers are being supplied, the aim should be to put up the butter in such form as suits them best. Always make it appear as neat and attractive as possible. The ten pound bail box makes a very convenient package; parchment paper lining and circles for top and bottom should be used. Very neat paper packages holding from one to eight or ten pounds are now on the market. These are usually made with parchment paper lining, and the circle for the top comes with the package. One of the most attractive ways of putting up butter, and the most convenient for the purchaser, is in the form of prints. For the last few years all of our butter that has not gone in tubs to the commission man, or to special customers out of town, has been put up in the form of pound prints. Each print contains sixteen ounces of butter stamped with our monogram, and wrapped first in parchment paper and then in a wooden veneer wrapper. This makes an ideal package, and without effort we have secured a trade for our butter which we have been unable to supply.

The best prices are obtained for good butter by contracting to private customers for the year. One has under these circumstances, however, to make his own collections and be responsible for regular and prompt delivery. Many prefer selling through commission men. But if the commission man is to get the best results for a patron making a small quantity, the butter must be made with such care and shipped with such regularity that not only the quality but the supply can be guaranteed to regular customers.

CLEANLINESS.

Anything upon the general subject of butter making without a reference to the care of utensils would be incomplete. Absolute cleanliness is positively necessary in all dairy work. Every article used in the dairy must be *clean*, and by clean we do not mean simply not dirty. A dipper or pan should not be called clean until it not only has every outward appearance of cleanliness but has been thoroughly scalded as well. It is our custom to first wash all utensils in warm water (not hot) then rinse in water scalding hot. Articles of tin are thoroughly steamed and then dried. Steam is not accessible on most farms. In the place of steaming, heat thoroughly about the stove or expose to the direct rays of the sun. Sunshine is a great purifier. In order to make possible a thorough cleansing of tinware, be sure the joints are well filled with solder.



MICHIGAN FRUIT LIST.

BY L. R. TAFT.

Bulletin 168—Horticultural Department.

Letters are frequently received asking for lists of fruits of various kinds that will be of value for planting in different parts of the State. Although the State Horticultural Society publishes such a list once in two years, it is not in the hands of all fruit growers, and to supply the evident want this bulletin has been prepared. The list contains such sorts as have been found generally successful under the conditions mentioned, but as the nature of the soil has much to do with the success that will be obtained with any variety, and as this often varies on the same farm, it is not claimed that the varieties mentioned will succeed in every instance. While it is hoped that the list given will prove of value, we would recommend all prospective planters of trees to study, if possible, how the different kinds behave in orchards where the soil and surroundings are similar to those which will be used for the young trees. Several of the varieties included in the list are comparatively recent introductions and, although they have been tested in the State and seem to have much promise, we would not advise their extensive planting, but they seem to have so many good qualities that we would suggest their trial on a small scale. As new varieties are being each year brought out, some of which prove to have merit superior to those of the older kinds, we would recommend that in order to take advantage of their merits and profit by the experience of others, instead of planting them extensively, the number obtained be barely sufficient to give them a test and to secure a stock of scions and that the required number of trees, of some variety that will make a good stock, be planted in the orchard, upon which to top-work such of these new kinds as show themselves to be worthy of extensive planting. In this way several years can be gained, and the danger of loss from the use of untested kinds will be much lessened. This method is particularly recommended for apples, pears and plums. Another advantage of this method of starting an orchard is that the danger of planting trees that may prove untrue to name is greatly lessened and, when strong growing, hardy stocks are used, as should always be the case, it will not only strengthen the growth of weak growing, but otherwise valuable varieties, but will render them more hardy.

In purchasing trees, it is generally advisable, when there is a reliable nursery in the vicinity, where first-class, home-grown trees can be obtained, to secure them there rather than to purchase trees grown at a distance, but if this cannot be done, or if the price is much higher than it will cost elsewhere for a similar grade of stock, one need feel no hesitancy in sending to nurseries in other parts of the State, or even in neighboring states, for trees. Aside from a half-dozen or so large nurseries which grow nearly all of their stock, a greater part of the plum, pear and cherry trees, and in many cases apples as well, are grown outside of Michigan, and, even when buying from the local nursery, it will often be found that the trees are not Michigan grown.

Farmers are frequently advised not to buy their trees from traveling agents or dealers. While this advice can often be followed to advantage, there are many agents who represent reliable nurseries and, where the honesty of the agent and the standing of the nursery can be depended upon, it will often be found that trees can be ordered through the agents that will be fully as reliable as those that would be obtained directly from the nursery, and the extra price of the trees would be but little if any more than the cost of the package and express for a small order. We would, however, particularly caution against any persons who make extravagant claims for the varieties they have for sale. While it is always desirable to secure first-class, well-grown stock, there will be no occasion to pay an extra price for trees grown by some special or secret method. Although there is some difference between varieties in their susceptibility to attack by diseases and insects, no varieties have yet been obtained which, under all conditions, are entirely free, and no faith should be put upon the claims of agents who agree to furnish trees blight or curculio proof for a price considerably higher than is charged for other kinds.

In selecting varieties of any fruit for home use, it is advisable to choose a sufficient number of kinds to cover the season and, if possible, to include varieties adapted to table use in a fresh state, as well as those that are particularly valuable for cooking and canning. While selecting varieties for market purposes, this is less necessary, although with many classes of fruit it is possible to handle them to the best advantage where a number of varieties are grown that ripen in succession. The kinds selected for market should have sufficient firmness to make them good shippers and it is always advisable to have fruit of large size and high color, and an endeavor should be made to combine these qualities of the fruit with high flavor, so far as possible. In all cases hardiness and productiveness of the trees are of the utmost importance. From the following one should be able to select a list of varieties that will succeed fairly well where any kind would grow.

SELECTION OF TREES.

For an ordinary planter medium sized trees should be selected. It is a mistake to use three and four year-old trees, as they will be less likely to live than younger ones and at the end of two years will be no larger, if they are as large, as when smaller sizes are used. A well-grown two-year-old tree should be from four to six feet in height, with a diameter of from five-eighths to three-fourths of an inch, and with several side branches. Older trees are likely to have a long, bare stem and the roots will be cut so short that they will be less likely to start than when younger trees with a large proportion of roots are used. Care should be taken that culls of a greater age are not substituted for the age ordered.

If possible, the trees obtained should be grown on a soil of about the same nature as will be used for the orchard, as, otherwise, injurious effects may be the result, especially when the trees that have come from a nursery soil that was very rich and well supplied with moisture are placed upon a moderately light loam where the water supply is deficient. The trees will be of a soft, succulent nature, and will be subjected to a severe check when placed upon the light soil.

Some nurseries make extravagant claims for the trees that they have for sale, owing to some special stock upon which it has been propagated, but all of the larger nurseries use about the same class of stocks and naturally have adopted such as they have found by experience to give best results, and where other stocks are used, the chances are that the trees will give inferior results. For most Michigan soils, ordinary apple and pear seedlings are adapted to standard trees of those fruits. Mahaleb stocks for cherry and Myrobalan for plum are commonly used, although, upon light soils, peach seedlings are often used with success for the plum. For growing the peach, it is desirable to use pits from natural trees from Tennessee, and, when one year from bud, they are of the proper age for planting.

Peach trees are always propagated by budding, and this method is very generally used for growing pears, plums and cherries, and is the favorite method with many eastern nurserymen for propagating apple trees, while western nurserymen commonly make use of root grafting. When well-grown there is little difference between apple trees grafted upon whole roots and those for which piece roots have been used, provided they are of fair length and not more than two cuts have been made from a root. Ordinarily, the budded trees will be somewhat larger than those propagated by root grafting, and, especially if the soil in which they have been grown is deficient in plant food, they will ordinarily be more desirable, as, to grow a root-grafted tree to the proper size for planting, upon such soil, would take three or four years, while the same size would be attained by budded trees, grown under similar conditions in two or, at most, three years.

Although all of the large nurseries of the country are inspected by official entomologists, from the fact that many of our most injurious insects are of small size and are sometimes found only upon the roots, these inspections should not be entirely relied upon, although it is undoubtedly of much value to the purchasers of trees, as well as to the nurserymen themselves, in preventing insects from establishing themselves in the nursery and being scattered over the country when the trees are sold. Especially when peach trees are purchased, it is desirable to soak them thoroughly, for a short time, in a strong decoction of tobacco water, and all trees should be carefully examined for the presence of insects or diseases of any kind, and if they are detected, proper remedies should be used for their destruction.

CARE OF TREES WHEN RECEIVED FROM THE NURSERY.

Whether purchased direct from the growers, or ordered through agents, care should be taken that the roots of the trees are not exposed to the action of the sun and dry winds. The practice of many farmers of placing their bundles in their wagons and driving home without taking any pains to cover them to prevent the drying of the roots has undoubtedly caused the loss of thousands of nursery trees. Wet straw and blankets should always be provided when notice has been received that the agent from whom the trees have been ordered is to make a delivery, and, as soon as possible, the trees should be either planted or heeled-in. When received in the fall, unless one has a cellar, where the temperature can be kept just above the freezing point, in which they may be placed with their roots in the soil, it will be desirable to heel-in the trees in some well-drained spot, where there will be no danger from standing water. A trench should be dug a foot or so in depth and about three feet wide, in which the trees should be placed with the tops inclined toward the south at an angle of about twenty-five or thirty degrees from the horizontal. The bundles should be opened and the soil thoroughly worked among the roots and pressed about them. It is always advisable to have the trunk and the greater part of the branches covered, especially in the case of peach and other tender fruits and whenever trees have not been thoroughly ripened. Care should be taken to have no straw or rubbish about the trees, but it is a good plan to use evergreen boughs to break the sun's rays and prevent the alternate freezing and thawing, as well as the rapid thawing of the trees after a severe cold spell. A trench should always be dug to carry off any surface water from about the trees.

DISTANCE OF PLANTING.

In setting the trees, the following distances will be found desirable under ordinary conditions: Apples, thirty-five to forty feet; pears, standard, twenty-five feet; pears, dwarf, fifteen feet; plums, eighteen to twenty feet; peaches, twenty feet; cherries, sweet, twenty-five feet; cherries, sour, twenty feet; grapes, ten by ten to ten by twelve feet for strong growing sorts, and eight by eight to ten by ten feet for the weak growing varieties; blackberries, eight by three feet to eight by five feet for large sorts, and seven by three feet for the small sorts; raspberries, seven by three feet to eight by four feet for the tall-growing varieties, and six by three to seven by three feet for the smaller sorts; currants and gooseberries, six by six feet if in squares, or seven to eight feet by five feet in the rows, and the English varieties of gooseberries as close as five by five feet; strawberries, three and one-half to four, by one and one-half to two feet, for matted row planting, and for hill culture twenty inches to two feet, or two and one-half feet if arranged in squares, or three to three and one-half feet between the rows, with the plants twelve to eighteen inches apart. While the longer distances may seem a waste of room, the trees and plants, when full grown, will occupy the entire space, if given good care, on strong soil, and not only will it greatly assist in cultivating, as it will make the use of the larger tools possible, but especially in dry seasons the fruit will be much larger and better colored. Where fungous diseases are troublesome, the planting of the trees at a good distance apart will permit the entrance of the sun's rays and the circulation of the air between the trees and lessen the injury from disease. While it may be admissible under some conditions, we advise against the planting of fruits of various kinds upon the same ground. Some persons seem to think that the planting of peaches between apples, and then setting raspberries or blackberries between the peaches, and strawberries between the rows of raspberries will effect a saving of space, but although it may be followed to some extent in the fruit garden, the practice is not ordinarily advisable in commercial plantations, as, even while the trees are small, they do not require the same care and none of them will do as well as if planted by themselves. Within a short time the roots of the trees will occupy the ground and nothing should be allowed to interfere with their growth. Even though the intermediate trees and plants are set with an idea of removing them before the trees need the space, it seldom happens that this is done until after some injury has been caused.

While we do not recommend it as a desirable practice, it will be less objectionable to plant early-bearing and short-lived varieties of apples between the rows, or at least in the rows with the trees, of slow-growing, late-bearing kinds like Northern Spy. Where the permanent trees are planted forty feet apart, it will generally be a dozen or fifteen years before there would be any very serious injury, if trees of Wagener, Jonathan and some of the other varieties were placed between them, so as to have the ground occupied by trees located twenty feet apart each way. In doing this, however, the supplying of the proper amount of plant food to make up for the increased drain upon the ground must not be neglected, and before the trees become so large that the branches interlace, the intermediate trees should be removed. If this is done, there will be comparatively little injurious effect upon the growth of the permanent trees, and the crops secured from the "fillers" up to the time of their removal should several times repay the entire cost of the orchard at that time.

PLANTING THE TREES.

It would be hardly possible to give too much care to the preparation of the soil for the orchard, or to the selection of the proper location for the trees. For nearly all trees a somewhat elevated site should be chosen, in order to escape extreme cold, as well as the danger of late frosts in the spring and early frosts in the autumn. There will ordinarily be much less injury from fungous diseases if the trees are placed in elevated, rolling sections, than in low lands or hollows.

The soil should be of a nature adapted to the particular fruit to be grown, peaches generally doing better than most other fruits on comparatively light soils, while in the order named, cherries, apples, pears, and plums would require heavier soils, and, where all of the above fruits are to be planted, a similar arrangement as to the elevation upon which they are placed should be made, peaches being placed on the higher levels and plums upon the lower.

For every kind of fruit a considerable amount of humus is desirable in the soil, and this can often be secured by turning under clover, field peas and other crops. If the land is deficient in plant food the use of decomposed manure will often be advisable, although care should be taken not to use an excess in the case of peach trees, as it would very likely result in a late growth and the winter-killing of the trees. After having plowed and thoroughly dragged the land, it should be marked out at the proper distances and holes dug for the trees. In some cases a plow can be used to good advantage to aid in digging the holes. The holes should ordinarily be of a depth that will permit of planting the trees slightly lower than they were in the nursery and of such a size as to take in the roots without cramping or bending. If the soil at the bottom of the hole is either very poor or very hard, it is advisable to remove an inch or two more and fill in with the best of the surface soil. In planting the trees the fine soil should be carefully worked among the roots and packed about them.

PRUNING THE TREES.

If the roots of the trees are broken, all injured or bruised portions should be cut away, and if, as is sometimes the case, there is a mass of dry, fibrous roots, these also should be removed. After planting the trees, the tops should be pruned by the removal of the surplus branches and cutting back the others. For apple, pear, plum and cherry trees, it is desirable to leave about four side branches, cutting them back to the length of four to six inches, with a center shoot that will be somewhat longer. If the trees are one year old, and unbranched, it is only necessary to cut off the stem at a point six or eight inches above where the branches are desired. In the case of peach trees, which have formed numerous side shoots, four of the stronger branches should be cut back to about two buds and all others removed. Where there are only a few side branches and a number of strong buds upon the main stem, the side shoots may be cut off and new branches formed from the undeveloped buds on the trunk, but in the case of large trees, on which all of the buds upon the trunk have developed into branches, the trimming to a whip, as is often recommended, is not advisable. If shoots start at all, they are likely to be small and misshapen and at points where they are not desired.

APPLES.

As a collection for family use, the following varieties are suggested: Yellow Transparent, Bough (Sweet), Oldenburg (Duchess), Primate, Gravenstein, Chenango, Maiden Blush, Shiawassee, Wealthy, Bailey (Sweet), Jonathan, Wagener, Hubbardston, Grimes, Baldwin, R. I. Greening, Red Canada, Northern Spy, Talman and Golden Russet. Among other kinds that generally do well, and in certain sections are of even more value than some in the above list, are Red Astrachan, Tetofski, Early Strawberry, Colvert, Porter, Fall Pippin, Oakland, Peck (Pleasant), King and Stark.

As market varieties nearly all of the kinds given in the first list will be desirable in their season, but as there is only a small demand for the summer and early fall varieties, comparatively few should be planted, except where the large cities can be readily reached and then such kinds as Yellow Transparent, Oldenburg and Shiawassee will generally be found profitable. In some sections Twenty Ounce does remarkably well, and for such locations it will be found a desirable market sort.

Of the other varieties mentioned, Jonathan is one of the most desirable, but it requires good care to bring the fruit to its full size. Baldwin should also be extensively planted in elevated sections and on well-drained soil. The trees are sometimes winter-killed upon low, wet land. Northern Spy, Hubbardston, Grimes and Red Canada are also valuable market sorts. Red Canada is a weak tree, but when top-worked upon some strong variety, is usually productive. Northern Spy has the serious fault of being a long time in reaching a bearing age, but the trees are hardy and long-lived, and the size and quality of the fruit render it especially valuable. In some states Ben Davis fruit is of a large size and fair quality, and as the trees are hardy and quite productive, it is a leading market sort. As grown in most parts of Michigan, however, it is somewhat smaller and of comparatively inferior quality, but many persons have found it among the most profitable sorts. Wagener is an early bearing, very productive variety, and unless the trees have excellent care, and are thinned while young, they soon become exhausted and die. With proper care it is one of the most valuable kinds for either home use or market purposes for the northern half of the State.

Of the other hardy kinds, Yellow Transparent, Tetofski, Shiawassee, Gravenstein, Wealthy, St. Lawrence, Pewaukee, Stark and Wolf River have been most thoroughly tested, and all of them have much merit for sections where ordinary varieties would fail. When the Russian varieties were introduced, it was hoped they would prove particularly valuable for the northern half of the State, but most of them ripen during the summer, or early fall, and they seem especially subject to the attack of twig blight, which renders many of them utterly unfitted for the colder portions of Michigan. Antonovka, Bietigheimer, Borovinka, Hibernal, Longfield, Switzer, Titovka, Thaler, Cross and Gypsy Girl have given best satisfaction.

PEARS.

For the home orchard the following varieties can be used, the number of the earlier kinds being comparatively small, while those ripening during the early fall will generally be most desirable, as they will be largely used for canning purposes. Of the early varieties Summer Doyenne, Osband, Bloodgood and Elizabeth (Manning) will generally prove satisfactory. For fall, use Clapp, Sterling, Boussock, Bartlett, Flemish (Beauty), Howell, Bosc, Mt. Vernon, Seckel, and Sheldon; among the desirable winter kinds are Anjou, Clairgeau, Lawrence, Dana Hovey, Winter Nelis and Easter (Beurre). These varieties succeed well as standards, but some of them, such as Anjou, Seckel, Bartlett and Howell, may be grown as dwarfs. Angouleme (Duchess) and Louise Bonne are also valuable sorts and should always be grown upon quince stocks. Of the kinds best adapted for market purposes, Bartlett should be placed well at the head, as it is generally a productive variety. Howell, Anjou, Lawrence and Angouleme are also valuable varieties for the market orchard. Although quite subject to blight and rotting at the core, Clapp is found desirable in some sections, while in others Flemish succeeds well, but not without thorough spraying, as it is usually much injured by leaf blight and scab.

For the southern half of the State, Keiffer is a productive variety, and when the fruit is properly thinned and ripened in the house, it is a fair variety for canning purposes. While its firm and coarse flesh is objectionable in one way, it renders it especially valuable for shipping. In some sections Seckel can be grown to a fairly large size by thorough cultivation and proper thinning, and as the fruit can be kept in cold storage for six or eight weeks, it will generally bring a good price, if thus handled. The late winter varieties when carefully picked, wrapped in tissue paper and placed in the cellar where the temperature can be kept at from 35 to 40 degrees, will often keep until spring.

Of the new varieties, Vermont Beauty is promising as a late summer sort, as it is quite productive and the fruit is handsome and of excellent quality. Wilder (Early) is also a valuable sort. Worden-Seckel, although not generally tested, will undoubtedly have much merit as a variety, both for home use and market, as it is equal to its parent, Seckel, in quantity and considerably exceeds it in size.

PLUMS.

For the most part, the varieties adapted for home use will be found desirable for market. Of these, in about the order of their ripening, are Field, Bradshaw or Niagara, Lombard, Pond, Imperial Gage, Italian Prune, Prince Englebert, Quackenboss, Kingston, Grand Duke, Black Diamond, Monarch, Stanton, Bavay, Shropshire and Golden Drop. Of the Japanese sorts Abundance, Burbank, Red June, Red Nagate, Satsuma, and Wickson have been tested and found of value.

The early European varieties are frequently attacked by brown rot, and the crop is sometimes ruined, and, as the canning season seldom begins before the first of September, the demand for them is usually comparatively small and prices rule low. Lombard has usually been considered one of the most productive and profitable varieties, but this has resulted in its being extensively planted, and, as a consequence, the markets are flooded and it has to be sold at a low price. For market purposes, the large, late, dark red or purple varieties seem most profitable and among them Grand Duke, Black Diamond and Monarch have the most merit. Where one has large numbers of Lombard and other strong growing, early varieties, the top-working of the trees with some of the late kinds above mentioned will generally be desirable.

The Japanese varieties start early in the spring, and the flowers are more likely to be injured by the late frosts than those of the European sorts. Several of the varieties ripen quite early, before the European kinds are on the market, and frequently bring a good price, but, as the market would soon be overstocked, the extensive planting of the early Japanese kinds cannot be recommended. Satsuma is generally productive and the fruit is excellent for canning purposes, but the dark red flesh is not particularly attractive and, until its merits have been learned by the public, it probably will not have an extensive sale. Wickson is an early-bearing, productive sort and will probably succeed wherever the peach can be grown. The fruit is quite large and of very fair quality. Its season is about the first of September.

PEACHES.

Whether for home use or market, it is desirable to have such a selection of varieties as will cover the season of this fruit. Alexander, Triumph, Hale, Rivers, Early Michigan, Lewis, St. John, Early Crawford, Barnard, Engle, Fitzgerald, Hills Chili, Elberta, Kalamazoo or New Prolific, Crosby, Late Crawford, Beers Smock, Stevens Rareripe, and Salway. As a rule, the earliest varieties are small and cling-stones, and the demand will be comparatively small. Previous to the ripening of Early Michigan and Lewis, there is no kind that takes high rank as a dessert or cooking variety. Early Crawford is one of the best known kinds and is fairly reliable upon strong, heavy soil in elevated sections, but upon sandy loam soil, and near the lake shore, its buds are likely to be winter-killed. Elberta is a large and handsome peach, and the trees are early and productive bearers when not injured by leaf curl, and, as this can be readily controlled, it should not be dropped from the list. This variety is also valuable as a market sort, on account of its excellent shipping and keeping qualities. Kalamazoo and New Prolific, although somewhat injured by leaf curl, are usually quite productive and their handsome appearance and high flavor make them valuable in any list. Crosby is one of the hardiest varieties in cultivation and often gives a crop in sections where others varieties fail. When the trees are well cared for and the fruit is properly thinned, it attains a fair size.

Among the new kinds that have not been generally tested, Triumph is well worthy of trial. Although it would rank as a semi-cling, it is about two weeks earlier than any other yellow peach, and as the trees are early and profuse bearers and the fruit is attractive and of good quality, it will undoubtedly take the place of the Alexander and the other early, white-fleshed kinds in the market. When the fruits are thinned so as to be at least six inches apart on the trees, they reach a fair size. Fitzgerald is a valuable kind to follow Early Crawford in the market, and wherever tested it seems to be one of the most hardy and productive varieties. It is a yellow peach of good size, attractive appearance and good flavor. Although not especially desirable as market varieties. Mountain Rose and Oldmixon are fairly hardy, productive and of good quality and are worthy of place in orchards for home use.

CHERRIES.

For most parts of the State, the sour varieties of cherries will be found most desirable both for home use and market. While the sweet cherries do well in many sections, and when well grown are a very valuable fruit on account of their large size and superior quality, the trees in other sections are often injured by the bursting of the bark upon the trunk and larger branches and, as a result die; they seldom attain their full size. The fruit, too, is often injured by brown rot and the blossoms are often destroyed by late spring frosts. For these reasons it can be seen that the sweet cherries are far less reliable than the sour varieties.

Of the sour cherries Richmond, Montmorency and English Morello will be found generally reliable, and as they ripen in succession, they will cover the greater part of the season. May Duke and Late Duke are also fairly productive, and the fruit of these varieties is larger and less acid than that of the kinds above mentioned. Brusseler Braune and Wragg are two varieties that have been grown in the State for the past ten or twelve years, and seem to be preferable to English Morello, as the fruit is larger, later and has longer stems than those of that variety. The trees are also rather stronger, better growers, and are fully as productive.

Of the sweet varieties, Early Purple, Gov. Wood, Bigarreau (Yellow Spanish), Napoleon, Rockport, Elton and Windsor are most generally successful. The bursting of the bark of these varieties can be lessened by the use of cover crops during the winter while the trees are young, and, later on, seeding the land to clover or grass. If the soil is fairly rich and supplied with moisture, it will have little if any injurious effect and will benefit the trees by checking their tendency to make a strong growth.

GRAPES.

The list of grapes for home use or market purposes differs but little from that recommended in the previous fruit list. Concord is still the leading black variety, while Worden has come rather more prominently into notice, as it is somewhat earier than Concord and less likely to be injured by early frosts in the fall. Moore is still somewhat grown as an early black sort. Although not fully tested in Michigan, Campbell (Early) is well worthy of trial, as the plants seem unusually strong, hardy and free from disease, while the fruit is of large size, both in berry and cluster, and ripens a week or ten days earlier than Concord. The pulp is tender, separates readily from the seeds, and is of excellent quality. The vines seem to be very productive, and as the fruit is said to hang a long time without dropping, it is probable that it will be an excellent shipping and a long-keeping variety.

Of the red grapes Delaware is most extensively grown, and, where it has a suitable location and good care, it is one of the most productive varieties. Although the fruit is small, the superior flavor of the pulp makes it one of the most valuable of table grapes. Brighton is less generally successful, but it has much merit as a variety for home use or local market. Salem is also highly prized and Vergennes and Diana are somewhat grown, owing to the fact that they have superior keeping qualities.

McPike is a new variety that has much promise. In a general way, the same claims are made for it as for Campbell and, judging from the appearance of the foliage and fruit, they can be easily substantiated. The vines are said to be very hardy, healthy and productive, and the fruit is attractive in appearance and of excellent quality.

Winchell, Diamond and Niagara are the best white varieties and cover the season fairly well. Winchell is a hardy, productive and early sort, and although its clusters are small, the fruit is of good quality. Diamond has much larger clusters and is one of the handsomest varieties grown. Niagara has been quite extensively planted as a market sort, and when well grown, generally brings a slightly higher price than can be secured for the black and purple varieties.

CURRANTS.

While the large-fruited varieties, such as Cherry, Fay and Versaillaise have much merit, where they can be grown to perfection, their canes are so injured by the currant borers that they are seldom profitable, and Red Dutch, Victoria and Prince Albert are generally preferred. While these kinds are not free from the attack of borers, they are much less injured than kinds with a large pith. The last is desirable as a late variety and it has the additional merit of being little injured by currant worms.

Of the new varieties, Pomona and London Market are very promising. They have fruit of good size, arranged in long clusters, and the plants seem to be quite productive. As yet they have not shown much injury from the currant borers. Red Cross is a strong-growing plant, but the canes seem to be much injured by borers. While the berries are of large size, the clusters upon the young plants seem to be rather short. White Grape is still the leading variety of its color, although White Transparent has probably some merit. There is little choice between Black Naples, Black Champion and Lee, of the black varieties.

GOOSEBERRIES.

Under ordinary conditions, the best results will be secured from varieties of American origin. Downing is still most extensively grown, but Pearl and Champion seem to have all of its good points, and are slightly larger in size and fully as productive. The English varieties are much injured by the powdery mildew, but if the bushes are planted in cool, moist soil, where they will have a free circulation of air, and are pruned so as to form a rather open head, there will be little trouble from the disease, when the bushes are thoroughly sprayed with liver of sulphur.

Industry is best known among the varieties of this species, but it is less desirable than Keepsake, Chautauqua, Lancashire Lad and Columbus. When properly handled, these varieties are quite productive, and the large size, juicy pulp and superior quality of the berries make them in every way more desirable than the improved kinds of American origin.

RASPBERRIES.

Hansell and Marlboro are among the best of the old varieties that ripen early in the season, while Miller and King are among the more promising of the new kinds. Cuthbert has as yet no superior for the main crop, although Loudon surpasses it in hardiness. The latter variety is a very promising sort upon rich soil, as, although the plants are of rather weak growth, they are productive and the fruit is of large size, quite firm and of very good flavor. Brandywine is in some sections highly esteemed as a market sort, and Golden Queen as a variety for home use.

Of the black varieties, Palmer, Conrath, Eureka and Kansas form a desirable list. Onondaga, Cumberland and Munger are promising new varieties. Shaffer and Columbian are strong-growing, productive sorts of the purple cane class, but, owing to their tendency to crumble, as well as their somewhat unattractive color and flavor, they do not take well as market sorts, except with persons who are familiar with their merits as canning varieties.

BLACKBERRIES.

Snyder and Taylor are among the hardiest and best blackberries, the latter having rather larger fruit than Snyder. Erie, Eldorado and Minnewaski also have some merit. Early Harvest and Wilson are productive varieties, and valuable if they can have winter protection.

STRAWBERRIES.

Among the better varieties for home use or local market are Warfield, Haverland and Clyde, while Bubach, Parker Earle and Brandywine will do well with intensive culture. For growing upon strong soil, where there will be an abundance of moisture and plant food, Marshall, William Belt and Glen Mary may be selected. Of the new sorts Carrie seems to have some claims as a substitute for Haverland, and Ruby, Margaret and Mayflower are also promising sorts, while Fountain, Hoosier, Knight, Morgan Favorite, Ridgeway, Seaford and Michigan have much merit.

NOTES FROM THE SOUTH HAVEN SUB-STATION.

BY L. R. TAFT AND T. T. LYON.

Bulletin 169.—Horticultural Department.

Nearly ten years ago the Board of Agriculture, realizing the importance of the fruit industry of Western Michigan, established a fruit testing sub-station at South Haven, in order that the growers of that section might be informed as to the varieties likely to thrive with them, as the climatic conditions at the main station near Lansing are quite different from those that prevail on the lake shore. The charge of the work was placed in the hands of T. T. Lyon, at that time President of the State Horticultural Society, and who has for many years had a national reputation as an expert pomologist. The work has been conducted in a satisfactory manner under the direction of Mr. Lyon, and at the close of each season he has presented a complete report of his operations with notes upon varieties under test. This has been published as a bulletin and has had a wide circulation. During the past year Mr. Lyon's health has failed, and although he was able to direct the work, he did not feel that he could prepare the report, and that the public might not lose the results secured during the season, the writer has undertaken to compile the report from notes prepared by Mr. Lyon and his assistants. The task has been greatly lessened by the completeness of the notes, and by the occasional visits that have been made to the station each year since it was established. For two years specimens of all the new varieties have been sent here, that they might be photographed, and descriptive notes were also taken of them. This greatly aided the preparation of the bulletin.

EXPERIMENT IN SPRAYING.

Aside from the applications required to control the insects and diseases, various experiments to determine which materials were most satisfactory and the best time to apply them were undertaken. For use as fungicides, Bordeaux mixture and solutions of copper sulphate of various strengths were tested. It has been thoroughly demonstrated that, for use after the foliage has started, Bordeaux mixture is the most satisfactory fungicide that we now have, but for the treatment made previous to the opening of the buds, fully as good results have been reported from the use of a solution of copper sulphate, at the rate of about one pound to fifteen gallons of water, and in order to satisfy ourselves fully upon this point, arrangements were made to spray a portion of the pear and apple trees with the copper sulphate solution and others with Bordeaux mixture of the usual strength, (four pounds copper sulphate, four pounds lime and forty gallons of water). As the plantation contains two trees of each variety, we were able to test the matter upon a large number of kinds. The spraying was given upon the 12th of April, the 2nd and 27th of May, and the 16th of June. Other applications of Bordeaux mixture were made to all of the trees. As a result of this thorough spraying, no scab or leaf blight appeared upon any of the trees, although unsprayed trees were badly affected. Examination at frequent intervals to compare the effects of the spraying with the copper sulphate solution with those secured with Bordeaux mixture, showed no difference whatever, and from the fact that the solution is less expensive as well as being easier to prepare and apply, it is to be recommended for the early spraying in preference to the Bordeaux mixture. The use of the application made during the dormant period of the trees is to destroy the mycelium and spores that have wintered upon the branches, and for this purpose it is not strange that the copper sulphate gives fully as good if not better results than Bordeaux mixture. On the other hand, the applications made after the growth has started are designed to prevent the germination of the spores that fall upon the young growth. From the fact that it is possible to use only a very weak solution of copper sulphate and that this is readily washed from the trees, Bordeaux mixture would naturally give better results, as it can not only be used of a strength several times greater than would be safe with a clear solution of copper sulphate, but the lime holds it for a long time upon the foliage and makes it possible to destroy any of the spores that fall upon them so long as it remains. The importance of thorough spraying will also be recognized, since, if any of the leaves or even portions of the leaves are not reached with the spraying mixture, there will be no effect in stopping the entrance of the germs.

One of the most troublesome diseases of the peach is commonly known as leaf-curl. Although of a fungous nature it seldom appears except during the spring and early summer of seasons when the weather is cold and wet.

For several years this disease has been quite troublesome in the orchards about South Haven, and in many instances the entire crop has been lost as a result. As long ago as 1892 the peach trees upon the sub-station grounds at South Haven were sprayed with fungicides and the results indicated that the disease could be prevented. Since that time the sprayings have been repeated nearly every year, and good results have been secured. In the spring of 1898, arrangements were made to test the effect of early with late spraying applications. One tree of a variety, of nearly one hundred kinds, was sprayed on the 25th of March, with Bordeaux mixture and on the 23rd of April another of each variety was sprayed. At that time, although the buds were much swollen, they had not opened. On the first appearance of the foliage, a marked difference was observable upon the two lots of trees, as where the spraying was done in March, comparatively few leaves were attacked, and in no case was it sufficient to reduce the crop, while on the trees sprayed April 23rd, a considerable amount of curl was observable, but much less than upon other unsprayed trees. Upon the 23rd of May all of the trees were treated with Bordeaux mixture, and Paris green was added at the rate of three ounces in forty gallons for the destruction of curculio and other insects. While the weather during the early part of the season was very favorable to the development of the leaf curl, the warm and comparatively dry weather that followed the blossoming of the trees checked further development and little if any benefit could be detected from the second spraying, so far as the leaf curl alone was concerned. Its use, however, was undoubtedly profitable in preventing the spread of brown-rot and the attack of leaf eating insects. With varieties subject to attack of brown-rot, a second application of Bordeaux mixture can generally be made with profit, and if the weather is favorable for its development, it will often be advisable to spray the trees with a solution of copper sulphate, at the rate of one pound to two hundred and fifty gallons of water, when the fruit is two-thirds grown. If the unfavorable conditions continue, another application of the copper sulphate solution should be made, within ten days.

The arsenites having been used upon all of the fruit trees in connection with Bordeaux mixture, the leaf-eating insects were readily held in check, but some trouble was found from the attack of black and green plant lice, especially upon the cherry and plum. For this a strong decoction of tobacco water was used and where any survived the first application, a second was made within a few days.

The woolly aphis having made its appearance on some of the apple trees, a bushel of wood ashes was scattered about each tree to destroy the form that infests the roots and the tops were at the same time sprayed with kerosene emulsion. This proved an effectual remedy, but in sections where wood ashes cannot be readily secured, tobacco dust upon the roots gives fully as good if not better results. The action of the dust can be hastened if the soil is scraped away about the trees down to the roots and replaced after the tobacco dust has been applied.

STRAWBERRIES.

As stated in the report of last year, the fifteen acres occupied by the sub-station is now practically covered with fruit trees and the bush fruits. A small area was planted in 1897 to strawberries, but no planting was made in 1898, as it was thought best, under the crowded condition of the land, to discontinue further tests of this fruit at the sub-station, relying upon the tests made at the Agricultural College. The tabular notes and the descriptions that follow have been made from the plantation of 1897. The fruit was set, as in previous years, so as to give each plant a space of about eighteen inches, and while one-half of them were kept in hills, the others were allowed to form narrow matted rows. Thorough cultivation was given during the season, as in the fall oats were sown between the rows to provide a winter mulch. The oats were sown about September first, and made a fair growth during the fall. The tops were killed during the winter, but with the mild climate at South Haven many of the stools were able to send up shoots in the spring, and made additional work necessary in order to prevent their growth. While oats may answer well in other sections, this liability to pass the winter and grow in the spring makes the crop of doubtful value along the lake shore.

TABULATION OF STRAWBERRIES. 1898.

ABBREVIATIONS—n, nearly; p, pistillate; c, conical; co, compressed; i, irregular; l, long; o, oblate; ob, oblong; r, round; b, bright; c. crimson; d, dark; l, light; s, scarlet.

SCALE—1 to 10; 1, feeble; 10, very vigorous.

Names.	Sex.	Vigor (1-10).	Date bloom.	Date first picking.	Date last picking.	Productiveness scale (1-10).	Form.	Color.	Quality (1-10).	Texture (1-10).	Weight (oz.).
Acme	b	10	5 6	6 6	6 29	10	c r	l s	6	6 7	¼
Annie Laurie	b	8 9	" 19	6 11	7 2	5 6	r o r	b c	5 6	7 8	¼ to ⅓
Arkansas Traveler	b	9 10	" 12	6 10	6 30	9 10	c i co	s	3 4	5 6	⅓
Aroma	b	7 8	" 13	6 11	7 2	9 10	r c i co	d c	4 5	4 5	½
Arrow	p	10	" 8	6 11	7 2	9 10	c r	d c	6 7	5 6	⅓
Auburn	p	8 9	" 13	6 11	6 30	9 10	c r i	d c	7 8	8 9	¼
Avery	p	8 9	" 4	6 10	7 2	10	c i	d s	4 5	4 5	¼
Beauty	b	7 9	" 4	6 12	7 2	10	o i co	d b s	5 6	6 7	⅓
Beecher	b	9 10	" 11	6 11	6 30	7 8	r o	c	5 6	4 5	⅓
Belt 3	b	7 10	" 8	6 14	7 2	7 8	c i	b c	5 6	6 7	⅓ to ½
Beverly	b	5 9	" 6	6 9	6 30	6 8	c rc i	d s	7 8	8 9	⅓
Bickle	p	6 7	" 8	6 9	7 2	9 10	r c	s	5 6	5 6	1-5
Bob Bubach (3353)	b	3	" 9	6 12	6 27	1 2	r c i	s	5 6	7 8	⅓
Bouncer	b	5 6	" 9	6 13	6 30	9 10	r c i	d c	7 8	6 7	⅓
Brandywine	b	7	" 13	6 9	7 5	6 7	r c i o	d c	7 8	10	⅓
Brunette	b	7 8	" 14	6 9	7 2	7 8	r c i	d c	9 10	9	⅓
Bubach 5	p	6 7	" 13	6 9	7 2	10	r c co i	s	5 6	5 6	⅓
Carnot	b	4 5	" 8	6 14	6 30	4 5	l c co i	d c	5 6	5	⅓
Carrie	p	5 7	" 9	6 13	7 2	5 7	c co i	b c	4	5 6	⅓
Carrie Crescent	p	3 4	" 13	6 13	6 20	2	c co	d c	4 5	4 5	¼
Chairs	b	4 5	" 4	6 11	6 30	8 10	rc i	d s	5 6	5 6	⅓
Champion	b	5 6	" 8	6 13	7 2	7 8	c ob co	d s	5	4 5	⅓ to ½
Champion (Eng.)	b	5 7	" 11	6 10	6 30	5 6	r c co i	s	4 5	7 7	⅓ to ½
Charley Crescent (2097)	b	2 3	" 9	6 13	6 23	2	r	c	4 5	5 6	1-5
Charlie	p	7 10	" 13	6 11	7 2	8	c	d c	5 6	7 8	¼
Cheyenne	p	1 2	" 16	6 13	6 27	1 2	r c co i	s	6 7	5 6	⅓
Cobden Queen	p	9 10	" 13	6 13	7 2	5 7	r rc i	d s	4 5	6 7	¼
Columbia	b	5 7	" 8	6 11	6 29	5	l c i	b s	5 6	5	¼
Columbian	b	8 9	" 9	6 13	7 2	5	r c o	b s	4 5	3 4	⅓
Crescent	p	8 9	" 9	6 6	7 2	8 10	r c r	s	5 6	5 6	1-5
Cruse	b	4 5	" 9	6 8	6 29	4 5	c rc co	l c	6 7	8 9	1-5
Curtis 15	b	9 10	" 7	6 8	7 2	9	r c co	s	6 7	5	⅓
Curtis 159	p	6 7	" 11	6 8	6 30	6 7	r c co	d s	5 6	7 8	⅓ to 2-5
Cyclone	b	9	" 6	6 7	7 2	7 8	c co i	l c b	6 7	5 6	¼
Daisy	p	7 8	" 9	6 1	6 29	9 10	r c o	d s	7 8	8 9	⅓
Dan Bisel	b	8 9	" 9	6 8	7 2	7 8	rc co i	b s	7 8	8	⅓
Dayton	b	5 6	" 12	6 10	6 29	6	c co i	s	6 7	4 5	⅓
Delia	p	8 9	" 19	6 13	7 2	7 8	c r c	b d s	7 8	5 6	⅓
Dollar	b	6 7	" 12	6 16	7 2	5 6	r c i co	s	4 5	6 7	⅓
Earliest	b	8 9	" 3	6 6	6 29	7	c co	s	6 7	9 10	1-5
Early Jack	b	5 7	" 2	6 9	6 29	8 9	r o r	l s	5 6	4 5	1-5
Edgar	p	9	" 14	6 13	7 2	7 8	r rc o	l s	4 5	4	⅓
Edith	p	3 5	" 13	6 12	6 30	4 5	r c co i	l c	7 8	6 7	½
Edwards	b	3	" 13	6 15	6 25	4 5	r c i	l s	5 6	4 5	⅓
Edwards (Fav.)	b	6 7	" 17	6 16	7 5	4 5	c i co	d s	7 8	7	⅓
Eleanor	b	6	" 13	6 11	6 30	6	c r o	d c	7 8	7 8	¼
Enhance	b	7 8	" 13	6 15	7 2	8	c r c	d c	7 8	9 10	¼
Epping	p	8 9	" 13	6 11	6 30	7 8	c co i	s	6 7	4 5	2-5
Equinox	b	7	" 13	6 15	6 30	8 9	c co i	c	6 7	7 8	⅓
Eureka	p	7 8	" 13	6 13	6 29	5 6	r c co i	l c	6 7	4 5	⅓
Evans	b	5 7	" 9	6 13	7 2	5	r o	s	4 5	2 3	⅓
Faux	b	6	" 8	6 11	6 29	4 5	c co	d c	8	5 6	⅓
Fifer, Gov.	b	7	" 10	6 15	7 2	5	r rc o	s	4 5	4 5	½
Fir	b	7 8	" 9	6 17	6 30	5 6	l c rc	b s	7 8	5 6	⅓
Fountain	b	10	" 8	6 6	6 29	10	c co	d c	7 8	5 6	2-5

TABULATION OF STRAWBERRIES, 1898—Continued.

Names.	Sex.	Vigor (1-10).	Date bloom.	Date first picking.	Date last picking.	Productiveness, scale (1-10).	Form.	Color.	Quality (1-10).	Texture (1-10).	Weight (oz.).
Fremont	b	5	5 11	6 15	7 2	5	r rc o	s	4 5	4 5	¼
Gardner	b	7 8	" 8	6 17	6 30	5 6	l c rc	b s	7 8	5 6	⅓
Giant	b	7	" 4	6 6	6 29	10	c co	d c	7 8	5 6	2-5
Gipsy	p	7	" 8	6 10	6 29	6	c co	d s	7 8	8	¼
Greenville	p	7	" 12	6 16	6 29	7	ob com	l c	5 6	6	⅓
Haights	b	7	" 8	6 9	7 2	5 6	c	s	4 5	4 5	¼
Haverland	p	8 10	" 6	6 9	6 30	9	l c	b s	8 9	7 8	¼
Hersey	b	8 9	" 8	6 11	6 25	5 6	c	b s	5 6	5 6	1-7
Holland	p	10	" 11	6 8	6 29	8 9	c i	b s	4 5	3 4	⅓
Hood River	b	4 5	" 9	6 10	6 30	5 6	r o	d c	5 6	7 8	⅓
Homestead	b	6 7	" 11	6 10	7 5	6	r c o	d c	8 9	7	⅓
Howell No. 2	b	4 5	" 8	6 11	6 30	5	c i	d c	5 6	6 7	⅓ to ½
Hyslop	b	6 7	" 8	6 4	6 27	8	c ob	d s	7 8	5 6	¼
Ideal	b	4 5	" 9	6 10	6 29	5 6	c	d c	6 7	9 10	⅓
Irene	p	5	" 9	6 10	7 1	10	c co	b c	7 8	8 9	¼
Isabel	b	8 9	" 13	6 9	6 30	10	c co i	d c	6 7	9	⅓
Kansas	b	7	" 8	6 9	7 2	10	r c	d s	7 8	7	1-5
Kennedy (Anna)	p	6 7	" 13	6 9	6 30	4 5	o	b s	6 7	5	¼
Klickita	p	9 10	" 8	6 11	7 2	6	r c o	d s b	7 7	5	⅓
King Worthy	b	7	" 9	6 11	7 2	8	r c	b s	3 4	4 5	⅓ to ½
Knight	b	7 8	" 11	6 9	6 30	10	c co i	b s	4 5	4 5	⅓
Kossuth	b	8	" 4	6 9	6 25	9	r c co	b c	5 6	5 6	⅓
Kyle	b	6 7	" 9	6 12	6 30	6	r o	b s	5 6	4 5	⅓
La Crosse	b	9 10	" 13	6 11	7 2	5	c co	b s	5 6	4 5	⅓
Lanahan	b	9	" 16	6 12	6 29	1 2	l c	s	5 6	8 9	1-5
Laxton No. 1	b	5	" 9	6 11	6 25	2 3	c i co	d c	8 9	9 10	¼
Leader	b	5	" 7	6 9	6 29	8 9	r c	d c	8 9	9	⅓
Lehigh	p	10	" 9	6 9	6 30	10	r c i	d s	6 7	8	¼
Leroy	p	7 9	" 9	6 11	6 29	10	r c i	b c	8 9	7	⅓
Lincoln	p	9 10	" 7	6 8	6 30	10	c i	d s	5 6	5	1-5
Little 42	n p	10	" 8	6 9	7 2	10	c i co	c l s	5 6	2 3	⅓
Longfield	p	8 9	" 7	6 11	6 30	10	c	b c	6 7	7	⅓
Lovett	b	9 10	" 9	6 9	6 30	8 9	c co i	b c	7 8	7 8	⅓
Mamie Warfield (606)	p	3 4	" 12	6 10	6 29	6	r o c	b s	3 4	3 4	1-5
Manwell	b	4 5	" 11	6 8	6 30	8	r c i	d c	4 5	5 6	⅓
Margaret	b	5	" 3	6 10	6 30	4 5	c co	d c	7 8	7 8	½
Marshall	b	7 8	" 5	6 9	6 30	5 6	c co i	b c	7 8	7 8	¾
Mary	p	5 6	" 9	6 11	6 30	5	r c i	d c	5 6	6 7	⅓
Maxwell	p	9 10	" 9	6 12	6 30	4 5	c co	d s	5 6	6	¼
Maybrott	b	3 4	" 4	6 12	6 27	2 3	r c i	d c	6 7	9 10	1-5
Mayflower	b	9 10	" 8	6 8	6 23	7 8	i c	s	6 7	6 7	⅓
McKinley	b	7 8	" 12	6 13	6 30	4 5	c	d c	6 7	5 6	⅓ to ½
Meeks	b	4 5	" 7	6 8	6 20	4	r c	d c	5 6	8	1-6
Minneola	b	3	" 16	6 12	6 30	4 5	o r c	l c	4 5	6 7	⅓
Murray	b	6 7	" 13	6 10	6 25	3	c r	b c	5 6	9 10	⅓
Noble	p	------	" 11	5 16	6 29	------	------	b c	7 8	8 9	------
No Name	b	5	" 13	6 11	6 30	5	c co i	d c	3 4	4 5	⅓ to ½
No. 7	b	5	" 8	6 13	6 23	3 4	c rc i	d s	3 4	5 6	⅓
No. 8	b	3 4	" 11	6 16	6 23	1	c co	l c	4 5	5 6	⅓
No. 40	b	10	" 11	6 11	7 2	9 10	r c i co	l c	6 7	4 5	¼
No. 1000	p	8 9	" 13	6 13	6 30	5	r	b c	5 6	6 7	⅓ to ½
Ocean City	p	2 3	" 15	6 14	6 30	2 3	r c co	b c	6 7	5 6	⅓
Odessa	b	7	" 13	6 13	7 2	5	r c i	b s	5 6	8	⅓
Omega	p	6	" 13	6 11	6 30	6	r c	b s	4 5	4 5	¼ to ⅓
Ona	p	8 9	" 4	6 8	6 25	5 6	r c o	d s	6 7	6 7	⅓

TABULATION OF STRAWBERRIES—Concluded.

Names.	Sex.	Vigor (1-10).	Date bloom.	Date first picking.	Date last picking.	Productiveness, scale (1-10).	Form.	Color.	Quality (1-10).	Texture (1-10).	Weight (oz.).
Orange Co.	p	8	5 9	6 9	6 30	10	r o	l c	5 6	6	⅓
Oregon	b	2 3	" 9	6 14	6 30	3	c co i	b c	6 7	8 9	¼
Oriole	p	1	" 13	6 14	6 23	1	c	d c	6 7	9 10	⅓
Orono	p	7 8	" 9	6 14	6 30	3 4	c i co	d c	7 8	6 7	¼
Oscar	b	1	" 19	6 16	6 20	1	------	------	------	------	------
Ostego	p	2 3	" 14	6 14	6 23	2 3	r	s	4 5	6 7	1-5
Paris King	b	7 8	" 8	6 8	6 30	9	ob c co	b s	5 6	8 9	⅓
Parker Earle	b	4	" 17	6 14	6 30	7 8	r c co	d s	4 5	6 7	⅓
Patrick	b	7	" 9	6 8	6 29	9	c co	b c	6 7	6 7	¼
Peabody	b	8	" 9	6 11	6 30	8	c co i	l s	3 4	3 4	¼
Perfection	p	3 4	" 13	6 14	6 30	2	c r c co	b c	4 5	8 9	⅓
Pet	b	5	" 13	6 16	6 20	½	r i	b c	6 7	5 6	⅓
Phipen	b	10	" 9	6 8	6 29	5	c i co	d c b	6 7	9	¼
Plow City	b	4	" 14	6 16	6 30	5	c i	l c	3 4	8	¼
Premium	p	6	" 17	6 16	6 30	4 5	o i	d s	4 5	5 6	⅓
Pride of Cumberland	b	3 4	" 11	6 9	6 25	4 5	r c	l c	4 5	5 6	⅓ to ½
Princeton	b	8 9	" 3	6 12	7 2	9 10	c	b s	3 4	4	¼
Richmond	b	2	" 9	6 11	6 30	5	c co i	d c	8 9	10	⅓
Ridgeway	b	5 6	" 14	6 13	6 30	4 5	r	d c	6 7	6 7	⅓ to ¼
Riehl (Ruby)	b	7	" 4	6 11	6 30	7	r c i	b c	7 8	8 9	⅓ to ½
Rio	b	7 8	4 30	6 3	6 25	6 7	c r i	l c b	7 8	9	¼
Rob Rusk	b	2	9	6 11	6 20	2	c	c	6 7	8 9	¼
Sandoval	b	3 4	" 9	6 11	6 30	4	c o	d c	8 9	8	¼
Satisfaction	b	7	" 9	6 11	7 2	4	c i	d c	6 7	3 4	⅓
Saunders	b	7	" 14	6 11	7 5	8	r c i p	d c	9 10	10	⅓ to ½
Shawnee	b	5 6	" 9	6 10	6 30	10	c co i	d c	4 5	5 6	⅓
Sherman	b	3 4	" 11	6 14	6 29	10	r o	b s	6 7	5	¼
Shyster	p	7	" 7	6 9	6 30	9 10	c r c	l c	3 4	3 4	⅓
Smalley	p	3 4	" 8	6 14	6 30	5	c i	d c	4 5	7	⅓
Smeltzer	b	7 8	" 4	6 8	6 22	6	r co	b c	7 8	6 7	1-5
Smith	b	8 9	" 1	6 6	6 22	9 10	r c i	d s	4 5	4 5	1-5
Snowball	b	8 9	" 8	6 9	6 28	3	c r	d s	5 6	8	¼
Sparta	b	5 6	" 4	6 8	6 22	4 5	------	---	------	------	¼
Stahelin	p	7	" 9	6 13	7 2	9 10	r c i o	b c	5 6	7 8	¼
Star	b	7	" 14	6 11	6 29	10	r c i co	d c	3 4	3 4	2-5
Splendid	b	7 8	" 9	6 9	6 30	8 9	r c o	c	4 5	7 8	⅓
Springdale	b	7	" 13	6 14	6 29	5 6	r c i	c	6 7	4 5	⅓
Staples	b	7	" 9	6 8	6 25	5 6	c i	d c	7 8	9	¼
Stewart	b	7	" 4	6 8	6 20	2 3	r c	d s	6 7	9	1-5
Stone (Ey)	p	4 5	" 11	6 9	6 25	3 4	c i	d s	3 4	6 7	¼
Sunnyside	p	7	" 14	6 13	6 30	6	r o c	s	3 4	3 4	¼
Sunrise	p	7	" 13	6 9	6 30	5 6	r co o i	d b s	5 6	5 6	⅓
Surprise	b	2	" 8	6 14	6 28	2 3	c ob	d c	6 7	5 6	¼
Tennessee	b	10	" 3	6 8	6 30	9 10	r c co	b c	6 7	8	⅓ to ½
Tennyson	b	6	" 11	6 12	6 30	4 5	r r c	d s	4 5	4 5	⅓
Thompson 40	p	9 10	" 13	6 14	6 30	8	r c	b s	3 4	5 6	⅓
Thompson 66	p	10	" 9	6 10	7 5	5 6	c co	d c	4 5	8 9	¼
Timbrel	p	7	" 14	6 14	7 2	5 6	r c i co	d b c	7 8	5 6	⅓
Tonga	p	5	" 9	6 16	----	6 7	r c co i	b c	4 5	4 5	¼
Topeka	b	6 7	" 11	6 14	6 28	3 4	l c co	d s	3 4	8 9	¼
Tubbs	b	1 2	" 14	6 14	6 28	1 2	c r o	b c	5 6	7 8	¼
Warfield	p	3 4	" 9	6 13	6 20	2	c o co	d b c	6 7	6 7	1-6
Welton	b	3	" 11	6 14	6 28	3 4	r c	l c b	3 4	7 8	⅓
Weston	p	1	" 13	6 14	6 25	------	---- --	-			------
Williams	b	7 8	" 11	6 8	6 28	5 6	c i	d c	9 10	8 9	⅓ to ¼
Will Warfield (147)	b	1 2	" 13	6 13	6 20	½	c	l s	3 4	4 5	1-6
Wood (Beder)	b	6 7	" 9	6 11	6 30	9 10	r r c	l s	3 4	4 5	⅓
Woolverton	b	8 9	" 13	6 11	7 2	8 9	l c co	c	8 9	9 10	⅓
World Champion	p	4 5	" 13	6 11	6 23	4 5	c r	s	4 5	6 7	1-7
Wyatt	b	6	" 13	6 11	6 30	3 4	r rc	l c	4 5	4 5	⅓

Among the varieties tested were several kinds from a western originator, that had been introduced by crossing a number of well-known sorts, and the names under which they were received were formed by uniting the names of the parents. Thus where the parents were the Hattie and the Warfield, the name given the new variety was Hattie Warfield and so on. Most of the plants were in poor condition when they were received and a very imperfect stand of plants was secured, while those that did start made a weak growth. Nearly all of the other varieties were tested at the college, and the description of the varieties has been given in Bulletin 163.

Among the more productive varieties were the Acme (6), Arkansas Traveler (3-4), Aroma (4-5), Arrow (6-7), Auburn (7-8), Avery (4-5), Beauty (5-6), Bickle (5-6), Bouncer (7-8), Bubach No. 5 (5-6), Crescent (5-6), Daisy (7-8), Fountain (7-8), Giant (3-4), Greenville (5-6), Haverland (8-9), Irene (7-8), Isabel (6-7), Knight (4-5), Lehigh (6-7), Leroy (8-9), Lincoln (5-6), Little No. 42 (5-6), Longfield (6-7), Orange County (5-6), Princeton (3-4), Shawnee (4-5), Sherman (6-7), Shyster (3-4), Smith (4-5), Stahelin (5-6), Star (3-4), Tennessee (6-7), Wood (Beder) (3-4), Woolverton (8-9).

All of the above varieties have a rating for productiveness of at least 9, and their quality is indicated by the numbers given in parenthesis, 10 meaning superior quality.

Of the kinds that fruited first in 1898 few of the following varieties have heretofore been described in the bulletins, either of the station or sub-station:

Carnot.—Bisexual plant, somewhat lacking in vigor. Fruits large, long, conical, somewhat irregular and compressed; color deep crimson. The flesh is dark crimson; seeds medium, sunken; texture moderately firm; core open; quality fair. Too poor in quality for a variety for home use, and its low vigor and productiveness prevent its being desirable as a market variety.

Delia.—Pistillate. A strong-growing productive variety, with large, roundish, conical fruits; color deep scarlet. Flesh bright scarlet; seeds small, sunken, reddish at maturity; texture moderately firm, and the flesh is of a sprightly, rich flavor. Season medium. A promising variety for either home use or market.

Faux.—Bisexual. Moderately vigorous, but lacking in productiveness. The berries are of large size, conical and slightly compressed; color dark crimson; flesh bright scarlet; seeds medium, slightly sunken; texture firm; core slightly open; flavor pleasant, rather rich. Quality good.

Kennedy (Anna).—Plant imperfect, fairly vigorous. Fruits medium size, oblate; color bright scarlet; seeds prominent, purple at maturity; texture quite firm; flavor sprightly, pleasant; quality fair. Somewhat lacking in productiveness. Season June 9.

King Worthy.—Plants fairly vigorous, perfect. Fruit large, roundish conical, bright scarlet. Flesh light; seeds medium, purple at maturity; texture not very firm; core spongy; flavor fair; quality medium; season June 11. The plants are only moderately productive, and the quality and firmness are so low that the berries are of little value for any purpose.

Manwell.—Plants moderately vigorous, perfect. Fruit rather large, roundish conical, irregular; color dark crimson; flesh bright scarlet; seeds very small, sunken, reddish purple; texture very firm; quality fair to good; moderately productive; season June 8.

Margaret.—Plants moderately vigorous, perfect. Fruit rather large, conical, compressed; color dark crimson; flesh dark scarlet; seeds numerous, purplish; texture quite firm with an open core in some specimens; somewhat lacking in productiveness; season June 10. A handsome variety, of much merit for market or home use if it proves sufficiently productive.

McKinley.—Plants quite vigorous, perfect. Fruit rather large, varying from conical to roundish conical; color quite dark crimson; flesh scarlet; seed prominent, reddish at maturity; texture moderately firm; flavor pleasant, quite rich, quality good; season June 13. A fairly productive variety, with some merit as a general purpose sort.

Minneola.—Plants perfect flowered. Fruit medium size, oblate to roundish conical; color rather light, but quite bright crimson; flesh light scarlet; seed prominent, red at maturity; texture rather firm; flavor mild; quality fair to good. Somewhat lacking in productiveness.

No Name.—Plants moderately vigorous, perfect. Fruit rather large, conical, compressed, irregular; color dark crimson; flesh scarlet; seeds prominent, purple at maturity; texture quite soft; core open; flavor mild; quality fair. Although moderately productive, the lack of firmness and poor quality of fruit render it of but slight value.

Ocean City.—Plants perfect flowered. Fruit medium size, roundish conical, compressed; color bright crimson, rather dark and of a handsome appearance; flesh scarlet; seeds prominent, greenish when matured; texture moderately firm; core open; flavor sprightly; quality good. If sufficiently productive, it may prove a valuable variety for market purposes.

Patrick.—Plants quite strong, perfect. Fruit medium size, conical, compressed; color bright and rather light crimson; flesh scarlet, seeds prominent; color greenish at maturity; texture quite firm; core slightly open; quality fair to good. Quite productive. A promising market sort; season June 8.

Perfection.—Plants perfect flowered. Fruit medium size, conical to roundish conical, compressed; color very bright crimson; flesh scarlet, seeds small, slightly sunken, red at maturity; texture rather firm; flavor pleasant; quality good; season June 14. A very handsome berry and if it proves sufficiently productive, it promises to be valuable either for home or market.

Premium.—Plants quite strong, imperfect. Fruit medium size, oblate, generally irregular; color dark scarlet; flesh light scarlet; seeds prominent, purple at maturity; texture moderately firm; core slightly open; flavor sprightly; quality fairly good; season June 16. Productiveness fair to good.

Pride of Cumberland.—Plants perfect flowered. Fruit rather large, roundish conical; color bright, light crimson; flesh scarlet, seeds numerous, prominent, brownish; texture quite firm; core open; flavor sprightly; quality good; season June 9. Fairly productive. Worthy of trial as an early market sort.

Peabody.— Plants fairly vigorous, perfect. Fruit medium size, conical, compressed, irregular; color rather light scarlet; flesh light colored, seeds sunken, greenish; texture rather soft; flavor slightly vinous; quality fair; season June 11; quite productive. Promising for near-by markets.

Ridgeway.—Plants fairly vigorous, perfect. Fruit large, roundish; color dark crimson; flesh bright scarlet; seeds prominent, reddish brown; texture quite firm; core open; flavor quite pleasant; quality good; fairly productive; season June 13. The plants thus far have been only moderately productive, but if this quality is developed it bids fair to be a valuable market variety.

Satisfaction.—Plants quite strong. Fruit medium size, conical, somewhat irregular; color light crimson; flesh bright scarlet; seeds numerous, sunken; texture rather soft; quality fair; season June 11. Only moderately productive.

Sparta.—Plants fairly vigorous, perfect. Fruit medium size, roundish, irregular; color bright, dark crimson; flesh quite pale; seeds numerous, small texture firm; flavor sprightly; quality fair; rather under the average in productiveness.

Star.—Plants quite strong, perfect. Fruit rather large, roundish conical, irregular, compressed; color dark crimson; flesh light scarlet; seeds many, slightly sunken, color purple; texture moderately firm; flavor vinous; quality fair; season June 11. The plants were among the most productive and promise well as a variety for local markets.

Stone.—Plants fairly vigorous, imperfect. Fruit medium size, conical, irregular; color bright, dark scarlet; flesh light scarlet; seeds sunken, greenish white; texture moderately firm; core open; quality fair; season June 9. Productiveness fair.

Sunrise.—Plants quite strong, imperfect. Fruit medium to large, roundish, compressed, irregular and sometimes oblate; color dark, bright scarlet; flesh light scarlet; seeds medium size; slightly sunken, reddish; texture quite firm; core open; flavor sprightly, pleasant; quality fair to good; season June 9. The plants are quite productive and it seems to be a promising sort either for home use or market.

Tennyson.—Plants quite strong, perfect. Fruit medium to large, roundish to roundish conical; color dark scarlet; flesh light; seeds medium size, purple; texture rather soft; core open; flavor not rich, but rather pleasant; quality fair to good; season June 12. Plants moderately productive. Valuable for local markets, if at all.

RASPBERRIES.

The trial plantation of raspberries was made in 1896, and is now in excellent bearing condition. After the plants had received their spring pruning, they were sprayed with a solution of copper sulphate, using one pound to twenty-five gallons of water, and after the new growth had started, an application of Bordeaux mixture of the usual strength was made for the prevention of anthracnose, and this proved sufficient to keep the new canes practically free from attack. No other disease nor insect appeared. After the plants had fruited, the old canes were cut out and oats were sown on the 23rd of August, as a winter mulch and to aid in ripening off the growth by the removal of surplus water from the soil. The season was quite favorable to the raspberry crop, and an excellent yield was secured from nearly every variety. Although most of the kinds have received attention in previous reports, the following descriptions are given under their respective classes:

American Red Raspberries, including supposed hybrids with the European Raspberry.—Among the more productive of the red varieties were Brandywine, Church, Cuthbert, Early King, Golden Queen, Hansell, Kenyon, Loudon, Marlboro, Miller, Reeder, Thwack and Turner, several of which are well-known commercial varieties. Among the older kinds, Cuthbert is among those best known, and it generally proves satisfactory. Although not especially productive, Hansell ripens about one week earlier than most of the other sorts, and being early and hardy, is a valuable sort for home use and in a small way, perhaps, for market.

King, for which high claims are made, on account of its supposed earliness, has not shown that characteristic to a marked degree, ripening four or five days later than Hansell and but two or three days before Cuthbert. The plants are quite hardy and of healthy though rather slender growth, owing to the tendency to sucker freely. Where the canes are properly thinned out, the fruits reach a fair size, comparing well with Hansell and the other early kinds.

TABULATION OF RASPBERRIES, 1898.

ABBREVIATIONS—c, conical; o, oblate; ob, oblong; r, roundish; b, blackish; p, pubescent; pu, purplish; r, red; y, yellow.

Number.	Name.	Species.	Bloom.	First picking.	Last picking.	Product—(1-10).	Form.	Color.	Average weight. (Ounces.)	Quality—(1-10)
1	Brandywine	Strigosus	6 3	7 8		10	r o	c	2-36	7 8
2	Cardinal	Neglectus	6 2	7 5	8 3	10	r	c	2-35	6 7
3	Carman	Occidentalis	5 28	7 2	7 22	10	r	b	2-50	5
4	Caroline	Neglectus	6 3	7 5	7 28	10	r	y	2-36	2 3
5	Centennial	Occidentalis	6 2	7 5	7 27	8 9	r	b	2-45	6 7
6	Champlain	Strigosus	--------	--	------		---------	-------		---
7	Church	Strigosus	6 3	7 6	8 5	9 10	r	r	2-32	7 8
8	Clark	Occidentalis	5 26	7 5	7 22	8 9	r	b	2-64	5 6
9	Columbian	Neglectus	6 6	7 9	7 30	8 9	r o	p	2-32	3 4
10	Conrath	Occidentalis	6 3	7 5	7 30	8 9	r	b	2-46	5 6
11	Cromwell	Occidentalis	5 30	7 2	7 27	10	r	b	2-54	4 5
12	Cuthbert	Strigosus	6 1	7 6	7 27	9 10	r	r	2-30	5 6
13	Diamond	Occidentalis	6 3	7 9	8 1	8 9	r	b	2-40	7 8
14	Doolittle	Occidentalis	6 1	7 5	8 5	10	r	b	2-54	5 6
15	Earhart	Occidentalis	6 1	7 2	8 5	8 9	r	b	2-45	5 6
16	Early King	Strigosus	6 1	7 3	7 25	10	r o	d s	2-32	7 8
17	Emmet	Neglectus	6 6	7 8	8 1	8 9	r	p	2-24	3 4
18	Eureka	Occidentalis	6 3	7 5	7 23	10	r	b	2-34	5 6
19	Farnsworth	Occidentalis	6 1	7 6	7 23	10	r	b	2-48	4 5
20	Gladstone	Neglectus	6 1	7 5	7 22	7 8	r	p	2-40	4 5
21	Golden Queen	Strigosus	6 4	7 6	8 1	7 8	r	y	2-30	7 8
22	Green	Occidentalis	5 31	7 5	8 3	9 10	r	b	2-50	6 7
23	Gregg	Occidentalis	6 4	7 11	8 5	8 9	r	b	2-46	8 9
24	Hansell	Strigosus	5 30	6 28	7 27	10	r	r	2-42	5 6
25	Herstine	Idaeus hyb ?	6 3	7 6	------	7 8	r o	r	2-26	9 10
26	Hilborn	Occidentalis	6 3	7 8	7 29	9 10	r o	b	2-64	5 6
27	Idaho	Occidentalis	6 4	7 9	8 5	8 9	r o	b	2-46	5 6
28	Indiana	Occidentalis	6 2	7 5	7 22	7 8	r o	b	2-42	5 9
29	Jap. Wineberry	Phœnicolasius	6 20	7 29	8 26	10	r	r		10
30	Johnston	Occidentalis	6 4	7 8	8 5	9 10	r	b	2-48	5
31	Kansas	Occidentalis	6 3	7 6	7 28	9 10	r o	b	2-46	5 6
32	Kenyon	Strigosus	6 6	7 9	8 5	5 6	r	r	2-29	4 5
33	Loudon	Strigosus	6 6	7 8	8 5	10	r	r	2-30	4 5
34	Lovett	Occidentalis	6 1	7 5	7 27	8 9	r	b	2-72	10
35	Marlboro	Strig's's Idaeus	6 1	7 2	8 3	10	r	r	2-32	5 6

TABULATION OF RASPBERRIES, 1898—Continued.

Number.	Name.	Species.	Bloom	First picking.	Last picking.	Product—(1-10).	Form.	Color.	Average weight. (Ounces)	Quality—(1-10).
36	Miller	Strigosus	6 2	7 2	8 26	10	r	r	2-32	7 8
37	Mills (15)	Occidentalis	6 3	7 8	7 30	8 9	r o	b	2 35	6 7
38	Muskingum	Neglectus	6 4	7 6	------	8 9	r ro	p	2 34	5 6
39	Nemaha	Occidentalis	6 4	7 8	7 27	3 4	r o	b	2-52	5 6
40	Ohio	Occidentalis	5 31	7 8	7 27	10	r o	b	2-48	6 7
41	Older	Occidentalis	6 1	7 5	8 1	10	r o	b	2-46	5 6
42	Otis	Neglectus		7 11	8 1	8 9	r	p	2-36	4 5
43	Palmer	Occidentalis	5 29	6 30	------	9 10	r	b	2-46	7 8
44	Phœnix	Occidentalis	6 1	7 2	8 1	5 6	r	b	2-44	6 7
45	Progress	Occidentalis	6 3	7 5	7 30	7 8	r	b	2-45	5 6
46	Redfield	Neglectus	6 9	7 9	7 30	8 9	r	p	2-40	3 4
47	Reeder	Strigosus	6 3	7 5	8 3	10	r o	r	2-34	8 9
48	Reliance	Strigosus	6 3	7 6	8 1	8 9	r	r	2-34	4 5
49	Sarah	Strigosus	6 12	7 27	8 20	1	------	------	------	------
50	Shaffer	Neglectus	6 6	7 9	8 5	8 9	r	p	2-38	5 6
51	Smith Giant	Occidentalis	6 6	8 1	------	.1	r	r	2-48	5 6
52	Smith Prolific	Occidentalis	6 3	7 6	7 30	9 10	r	b	2-55	9 10
53	Souhegan	Occidentalis	5 31	7 2	7 30	8 9	r o	b	2-70	5 6
54	Strawberry-raspberry	Rosaefolius	6 9	7 15	------	5 6	r obi	r	2-6	2 3
55	Superlative	Idaeus	6 1	7 5	7 25	8 9	l c	r	2-20	4 5
56	Thompson	Strigosus	6 3	7 2	7 22	8 9	r	r	2-40	4 5
57	Thwack	Strigosus	6 4	7 5	8 24	10	r	r	2 40	5 6
58	Turner	Strigosus	6 4	7 5	8 1	10	r	r	2-44	8 9
59	Tyler	Occidentalis	6 1	7 2	7 30	10	r	b	2-48	5 6
60	Winona	Occidentalis	5 31	7 5	7 20	7 8	r	b	2 96	5 6

Kenyon and Loudon have been fruited for three years, and although they show slight differences in productiveness from year to year, owing to the different ways under which they have been grown, in other respects they are practically identical, the size, shape, color and flavor of the fruit being the same and the first and last fruits were gathered upon the same days. The vines seem quite hardy and productive, and as the fruit is of large size, slightly exceeding that of Cuthbert, quite firm and of an attractive color, they seem to be very promising as market sorts, although in quality they are not equal to Cuthbert. These varieties, as well as Hansell, King, Miller and others, seldom branch and with them the practice so commonly recommended a few years since to pinch back the tips of the new canes when they reach a height of two feet or thereabouts, is not advisable. When allowed to grow naturally, the canes form strong buds, from which the fruiting branches will be developed the following season, while if the ends are pinched, the buds will develop the first year into slender shoots, upon which the fruit buds will be weak. As a result of this the fruit will generally be small, and may often fail to develop, and there will be an increased tendency toward winter killing. Hence, for the non-branching varieties, the practice of pinching back the new growths in the spring is not to be recommended.

Miller is of less vigorous growth than Cuthbert, but the plants seem hardy and productive and the fruit is large and of high quality, being sweet and pleasant in flavor. The color is attractive, and it seems to be a promising variety for home use and for markets that are easily reached, but the fruit is rather tender for distant shipments.

Thompson has again failed to show valuable characteristics, as the fruit is quite small and of inferior quality; and it is a medium season variety, although high claims were made for it as an early sort.

Black Raspberries.—The old variety like Carman, Clark, Cromwell, Doolittle, Earhart, Hilborn, Lovett and Souhegan, although fairly hardy and productive, produce fruit of a comparatively small size, and unless the plantations are frequently sprayed are quite subject to anthracnose, so that there seems to be little need of retaining them in the fruit lists, as there are many well-known kinds that equal them in other respects, and produce fruit of a good size.

Palmer this year gave ripe fruits two or three days before any of the other kinds, and as it has been thoroughly tested, in all parts of the State, and found hardy and productive, with fruit of a good size, it seems well worthy of its place as an early variety for market.

Clark fruited for the first time in 1898. Although the plants are rather small, they were fairly productive. The berries were somewhat injured by the drought, but were of good size compared with those of surrounding varieties. The fruit was firm, somewhat lacking in juice, but of a sprightly and rich vinous flavor. Under more favorable conditions it would undoubtedly have made a much better showing.

Conrath follows within a few days and seems equal to the Palmer in all respects, except in quality, and has the advantage of being larger.

Diamond is a new variety with a strong growing, healthy plant, and late in its seasons of ripening. The fruit is very large, moderately firm and of high flavor. From its behavior the last two years, it seems to be a promising variety for either home use or market.

Eureka has again made an excellent showing, as a large, medium late variety. The plants are of strong growth and quite productive. Although the fruits are not of the highest quality, it has much merit as a market sort.

Farnsworth is a vigorous and healthy plant, and has for two years been one of the most productive varieties. It is above medium in size, and of good although not high quality. The clusters are large, upon rather long, stout fruit-stalks, and the berries are quite firm and moderately juicy. Although not thoroughly tested in other sections, it seems to be valuable variety for market purposes, or for home use.

Green also has some valuable points, although rather less vigorous than Farnsworth. It has been quite productive, and the fruit, besides being of good quality, is firm enough for shipment. The clusters are medium size, upon short and rather slender fruit stalks. The principal objection to the variety noted this year is that the fruit averages rather small in size, although it was nearly as large as Gregg, which for some reason was considerably under size and was hardly up to its usual standard in productiveness.

Idaho has a firm berry that should make it valuable either for market purposes or for evaporating. The plants are vigorous and quite productive and the fruit which is much above the average in size, is borne in large, compact clusters, upon short and rather stout fruit stalks. Its color is nearly black, but it is covered with a dense pubescence. The flavor is sprightly and slightly vinous.

Indiana was less promising than in other years, the growth of the canes the previous year having been rather small. The plants, however, were quite productive and the fruit was of large size in quite large clusters upon moderately long stalks. The fruit was firm and somewhat lacking in juice, but of a pleasant and rich flavor, so that it seems valuable for market or dessert purposes; color black, with a plentiful pubescence.

Johnston made a satisfactory growth and was quite productive, but the fruit was very small and of poor quality.

Kansas has a vigorous and healthy plant and was among the more productive kinds, although the fruit the past season was unusually small. The clusters are quite large and compact, and the fruit is borne upon short, moderately stout stalks. The berries are of a mild flavor and being quite firm and only moderately juicy, it is a valuable sort for market purposes.

Mills (No. 15) was rather less productive than in 1897, but gave a large amount of fine berries. The clusters were large and compact, upon moderately long and stout fruit stalks. The berries were firm, and of a rich, pleasant flavor; color, black with a plentiful pubescence. Promising either for commercial plantations or for the home garden.

Phoenix after two years trial, has failed to show its value. The plants are somewhat lacking in vigor, and are far below other varieties in productiveness. The clusters are medium in size, with berries upon long, slender pedicels; color, black, moderately juicy and of a mild, pleasant flavor.

Progress is moderately vigorous and fairly productive, although not equal to its record of 1897. The berries are of good size and are borne upon short, moderately stout fruit stalks, in compact, medium-sized clusters. They are moderately juicy, firm; and being of a rich, sprightly flavor, are valuable either for the home or market plantation.

Smith *(Prolific)* is a strong growing, productive sort, with moderately large fruits of excellent quality, the flavor being rich and sweet. The berries are firm, moderately juicy, and it appears to be a promising sort.

Winona.—Two years fruiting of this variety has failed to develop any valuable points. It is somewhat lacking in vigor, and has not shown any marked productiveness. The berries are rather small, in clusters of medium size. They are moderately juicy and of a mild flavor.

Hybrid American Varieties.—Varieties of this group resemble the black-caps in the habits of the plant, although the fruits in their structure and color are nearer like the red sorts. As a rule they are strong growing, vigorous plants, and the fruit is large, inclined to crumble and of a dull and mealy appearance. For home use, many of them are highly esteemed for canning purposes, and in many sections they are largely grown for local markets.

Cardinal, a variety from Kansas, has produced several excellent crops. The clusters are large, rather loose, upon medium stout fruit stalks. The berries are quite large, slightly conical, compact and fairly firm, somewhat lacking in juice, but of a rich and sprightly flavor. They are of a dull crimson color, and with a slight pubescence.

Columbian has strong growing, vigorous plants, which have for several years been quite productive. The fruit is roundish-oblate in form, of a dull purple color, with an abundant pubescence, and is borne upon pedicels of moderate length, in large, moderately compact clusters. Although the fruit is somewhat firmer than that of the Shaffer, it is still rather soft for long shipments. Moderately juicy, with a peculiar vinous flavor. The plant seems much less affected by the anthracnose than those of Shaffer, and consequently are hardier and more productive under average conditions. One of the best of the purple-cap varieties for market or culinary purposes.

Emmet.—The plants seem fairly vigorous and quite productive for their age. The fruits are quite large, in small, compact clusters and on rather short pedicels. Form, roundish, moderately firm and of a dull purple with a moderate amount of pubescence. Fairly juicy and quite firm for a variety of its class. Flavor, sprightly and vinous. Valuable only for culinary purposes.

Gladstone has strong growing plants which are fairly productive in the usual fruiting season and often give a second crop upon the ends of the new canes. Berries large, slightly conical, borne on stout, moderately long, smooth pedicels, in compact clusters; color, purple with a plentiful pubescence. Moderately juicy and of a sprightly flavor. They crumble readily and the variety is of value only for home use, if in any way worthy of cultivation.

Muskingum is a strong-growing, productive sort, that has large, moderately compact clusters of fruit on medium long, rather stout pedicels; color, purple, with an abundant pubescence. The fruits are of the largest size, fairly firm and with abundant juice. The flavor is sprightly and vinous, and the variety is quite valuable either for culinary or for market purposes.

Otis, for recently set plants, shows considerable vigor and was quite productive. The fruit was large, roundish, conical, purple and with an abundant pubescence. The clusters were large, moderately compact and with rather short, slender fruit stalks. The variety is valuable for market or culinary purposes.

Redfield has plants moderately strong and fairly productive. Fruits medium to large, roundish, purple and with a medium amount of bloom. Clusters large, moderately compact and with rather slender fruit stalks. Quite juicy and of a vinous flavor, although not of high quality. Promising for market or culinary purposes, on account of its hardiness.

Shaffer, in young plantations and where uninjured by anthracnose, is a vigorous, hardy and healthy variety and is ordinarily one of the most productive. Fruit among the largest in size, roundish, purple and with a plentiful pubescence. Clusters large, moderately compact, with short, moderately stout fruit stalks. The berries have a moderate amount of juice and are of a delicate texture, and hence are easily crushed. Flavor rich, vinous and peculiar. Largely grown for market and culinary purposes.

Several varieties supposed to be hybrids, between the European and American raspberries, have been grown for a number of years, but they are somewhat lacking in hardiness and are not sufficiently vigorous and productive to make them of value, either for home use or market, although for an amateur, who desires a raspberry with high flavor, some of these kinds may be of value. With slight protection they will pass the winter without injury and, with high cultivation, will give a fair amount of fruit of large size, delicate texture and superior flavor. Herstine and Belle de Fontenay are among the best known varieties.

Superlative has shown itself of weak growth and only moderately productive. The few fruits borne, however, were of large size, long conical in form and of a crimson color. The clusters were large, compact and upon stalks of medium size. Fairly firm and juicy and of only mild flavor. It seems to have little value as a market sort, and its deficiency in flavor destroys any advantages it might have for dessert use.

Raspberry Novelties.—Of the three forms of raspberry that have been introduced during the last five or six years with the highest praise and for equally high prices, none have shown any value whatever. The Wineberry has been referred to several times in previous bulletins, and the results this year are no more satisfactory than those previously secured.

The Japanese Mayberry (*Rubus microphyllus*), although protected, has been somewhat injured by the winter and it did not fruit. It is hardly likely that it will prove of value in any portion of Michigan.

Logan has also failed to fruit. Even if it should prove hardy and productive, the appearance and texture of the fruit are likely to prevent it ever being of any value for general planting.

Strawberry-Raspberry (*Rubus rosaefolius*), as reported last year, bids fair to become a troublesome weed, and, as it has no value, its introduction should be discouraged. The fruits are quite large and of a strikingly bright scarlet color. The berries consist of small, rather dry pips and are developed upon a very large receptacle, so that they have something the appearance of a large, flattened thimble. The flesh is rather dry and has a peculiar flavor. It is of no value whatever.

BLACKBERRIES.

The blackberry plantation received the same treatment as the raspberries, and was quite free from both insects and diseases. Early in August, the leaf miner appeared upon the foliage, and the infested leaves were gathered and burned. The season being very favorable, a large crop of fruit was secured. None of the varieties were injured by the winter. Among the more productive of the new sorts were Lincoln, Minnewaska, Nevada, Ohmer, Reyner, Sanford; and nearly all of the old standard kinds, planted for comparison, gave good crops, none of them being marked less than eight, upon a scale of eight to ten for productiveness.

Childs *Tree* was only moderately vigorous, or productive, but the fruit was of good size, roundish-oval and borne in clusters of medium size. The berries were moderately firm, quite juicy and of a mild and pleasant flavor. It does not show any tree-like characteristics.

Early King ripened soon after Early Harvest and seems to be larger and of better flavor than that variety. The berries are oblong in form and consist of large, moderately compact fruits. They are quite juicy and have a pleasant, vinous flavor. One of the most promising of the early varieties.

Early Mammoth has for two years shown itself very vigorous and productive. The fruit is of a large size, irregular oblong in form, and is borne in large compact clusters. The berries are moderately juicy and of a mild flavor. Seems to be a promising sort for either home use or market.

Eldorado is a highly praised variety of medium size, which has shown itself to be of more than average vigor and productiveness, but it hardly warrants the praise it has received. Although the plants are somewhat different in growth from those of Snyder, there is a general resemblance in the fruit to that variety. It seems to be quite hardy, and it is possible that further trial may develop its good points.

TABULATION OF BLACKBERRIES, 1898.

ABBREVIATIONS—i, irregular; o, oblong; ov, oval; r, roundish; b, black.

Number.	Name.	Planted.	Bloom	First picking.	Last picking.	Product—(1-10).	Form.	Color.	Weight in oz.	Quality—(1-10).
1	Agawam	1888	6 4	7 23	8 24	8 9	r o i	b	2-14	7 8
2	Ancient Briton	1888	6 5	7 27	8 24	8 9	o	b	2-16	3 4
3	Childs (Tree)	1888	6 13	7 25	8 24	8 9	r o	b	2-16	4 5
4	Early Harvest	1888	6 10	7 17	8 1	8 9	o	b	2-30	5 6
5	Early King	1890	6 4	7 19	8 1	8 9	i o	b	2-22	7 8
6	Early Mammoth	1888	6 8	7 23	8 20	10	i o	b	2-15	6 7
7	Eldorado	1894	6 4	7 23	8 20	7 8	o	b	2-18	6 7
8	Erie	1888	6 6	7 26	8 21	8 9	o	b	2-12	4 5
9	Fruitland	1888	6 10	8 1	8 15	7 8	r o	b	2-22	4 5
10	Kittatinny	1888	6 6	7 25	8 27	9 10	o i	b	2-14	7 8
11	Knox	1888	6 4	7 23	8 31	9 10	o	b	2-16	6 7
12	Lawton	1888	6 4	7 22	8 15	10	o	b	2-16	6 7
13	Lincoln	1893	6 3	7 28	8 27	10	r	b	2-25	8 9
14	Lovett (Best)	1896	6 6	7 29	8 24	7 8	r	b	2-25	5 6
15	Maxwell	1894	6 6	7 20	8 22	8 9	r o	b	2-20	5 6
16	Minnewaska	1888	6 6	7 26	8 31	10	r o	b	2-14	5 6
17	Nevada	1888	6 5	7 25	8 31	10	o	b	2-14	5 6
18	Ohmer	1893	6 3	7 24	8 31	10	r	b	2-16	6 7
19	Oregon (Everbearing)	1893	6 21	8 11	8 30	8 9	o	b	2-40	5 6
20	Piasa	1895	6 3	7 25	8 20	5	i o	b	2-20	5 6
21	Reyner	1896	6 3	7 23	8 20	9 10	o	b	2-34	5 6
22	Sanford	1894	6 4	7 26	8 27	9 10	o	b	2-34	4 5
23	Snyder	1888	6 4	7 23	8 24	8 9	o	b	2-22	10
24	Taylor	1888	6 3	7 26	8 22	10	o r	b	2-16	9 10
25	Thompson	1888	6 4	7 18	8 24	9 10	o	b	2-12	3 4
26	Triumph (Western)	1888	6 4	7 28	8 24	10	r o	b	2-30	4 5
27	Wallace	1888	6 5	7 22	8 31	10		b	2-16	6 7
28	Wilson	1888	6 4	7 20	8 24	9 10	i o	b	2-10	3 4
29	Wilson, Jr.	1888	6 3	7 20	8 24	9 10	i o	b	2-10	3 4

Lincoln has been quite vigorous and productive. The fruits are medium size moderately firm and with a large amount of juice. The flavor is rich and pleasant, and if the plants prove hardy in all sections, it promises to become a standard variety for home use or market purposes.

Lovett *Best*, although recently planted, has made a fair growth and gave a good amount of fruit. The fruit is roundish, inclining to oval, and is of a compact form, with a moderate amount of juice. The flavor is pleasant and mild. It has not been grown sufficiently long to enable it to make the best possible showing.

Maxwell also made but a moderate growth, but it slightly exceeded the productiveness of Lovett. The fruit is somewhat large and of a mild flavor. Its loose texture would seem to make it of value only for near-by markets, or for home gardens.

Minnewaska was one of the most vigorous and productive varieties grown. The fruit was of large size, roundish oblong and was borne on rather stout, smooth pedicels in clusters of medium size that were moderately compact. The berries were fairly firm and with a plentiful amount of juice; flavor mild. A promising variety for general planting.

Ohmer, although among the last of the kinds to be planted, has shown excellent vigor and productiveness. The fruits are roundish-oval and are borne in quite large, compact clusters, on smooth pedicels, of medium size. The fruits themselves are fairly firm, but with a plentiful amount of juice. The flavor is pleasant but mild. The large size of the fruits, combined with the vigor and productiveness of the plants, makes it a promising kind for market, and one that is also valuable for home use.

Oregon *Everbearing* has made a vigorous growth and, the past year, has been moderately productive. It is a trailing variety, with cut-leaved foliage. The fruits are quite small, oblong, and quite compact. They are moderately juicy, and with a pleasant flavor. It seems to have no special value.

Piasa is of rather weak growth and lacking in productiveness. The fruit is rather small, of an irregular oblong form, borne in small compact clusters. The berries are compact, somewhat lacking in juice and of a mild flavor. The plants do not seem thoroughly established, and this may account for the poor showing they have made.

Reyner was planted in 1896 and has made a strong growth, and during the past season produced a good crop of fruit. The berries were rather small, varying from oblong to oval in form, and were rather compact and with a plentiful amount of juice; flavor sprightly and pleasant. If, after the plants have become better established, the size of the fruit is increased, it promises to be a valuable variety, either for home use or market.

Sanford made a comparatively weak growth, but was fairly productive, although the berries were rather small in size. The clusters were quite large, moderately compact, and the fruit ranged from oblong to oval in form. Rather firm and with a moderate amount of juice. Favor pleasant and vinous, but not of high quality.

Thompson was among the earliest to ripen, and although the plants were not especially vigorous, they were quite productive. The berries were quite large, of an irregular, oblong form, and were borne in large, loose clusters. They were fairly firm and with a moderate amount of juice, but the flavor was slightly unpleasant. If it shows hardiness under average conditions, it may prove a valuable variety for market.

Of the common kinds, Kittatinny, Lawton, Snyder, Taylor, Western Triumph and Wallace all gave good crops, slightly excelling Agawam, Ancient Briton and Erie, although these kinds produced a fair amount of excellent fruit.

CURRANTS.

The plantation of currants contains twenty-four varieties, most of them three years transplanted, although several new kinds have recently been added. The usual treatment with fungicides was made, the first application being given March 18, before growth had started, and as soon as the worms appeared, they were sprayed with Bordeaux mixture, for the prevention of fungi, and Paris green for the worms. This treatment sufficed to hold the insects in check and saved the foliage from the attack of fungi so that it remained upon the plants in a healthy condition long after all of the leaves had fallen from unsprayed plants. This enabled the bushes to ripen their wood as well as to form strong fruit buds for the crop the coming season. On the 2nd of June, aphides having appeared upon Long Bunch Holland and spreading to the surrounding varieties, the infested bushes were sprayed with tobacco water, and further injury was thus prevented. The season was quite favorable to the currant crop, and a large yield was secured from most varieties. In former years some injury had been done by the currant stem borer, but by cutting away all infested branches and the thorough use of insecticides, the injury has been greatly reduced, although it is impossible to tell to what extent the destruction of the borers has been due to the spraying.

Of the older kinds, good crops have been secured from Cherry, Fay and Versaillaise, although they have been discarded by many persons as market varieties on account of the injury from the twig borers. Although distinct in their origin and with slight differences in bush and berry, there is a general resemblance between them. The bushes are of medium height and with stout shoots and thick, dark green, wrinkled leaves. The berries of Fay and Cherry are quite large, but the former, as a rule, has somewhat longer stems. The Versaillaise has berries somewhat smaller than those of the other varieties, but the length of the stem and the arrangement of the berries is similar to that of Fay. The large size of the berries will make these valuable kinds where they can be grown without danger from the twig borers, but where this cannot be held in check, all of them and Fay in particular, will be greatly injured.

TABULATION OF CURRANTS, 1898.

KEY; Form—r, roundish. Color—b, black, r, red, w, white. Use—d, dessert, k, kitchen, m, market.

Names.	Origin.	Planted.	Bloom.	Ripe.	Productiveness. 1–10.	Form.	Color.	Quality.	Vigor.	Weight in oz.	Use.
Champion	England	1889	May 3	7 12	10	r	b	5 6	7 8	2–12	m k
Cherry	Europe	1888	April 28	7 5	10	r	r	5 6	8 9	2–8	m
English	England	1892	May 8	7 9	10	r	b	5 6	10	2–10	m k
Fay	New York	1888	April 28	7 5	10	r	r	6 7	6	2–6	m k
Holland	Europe	1889	" 29	7 15	10	r	r	5	9 10	2–10	m k
Lakewood	Ohio	1890	" 27	7 15	5	r	r	6 7	7 8	2–6	m k
Lee	America	1888	May 3	7 12	7 8	r	b	3 4	4 5	2–20	m k
London	England	1890	" 1	7 9	10	r	r	4 5	9 10	2–10	m k
North Star	Minnesota	1890	April 27	7 5	9 10	r	r	7 8	10	2–10	m k
Pomona	----------	------	" 29	7 11	1 2	r	r	7 8	4 5	2–14	m k
Red Dutch	Europe	1838	" 27	7 11	7 8	r	r	7 8	10	2–8	d k
Ruby Castle	Europe	1892	May 1	6 25	9 10	r	r	6 7	9	2–10	d k
Ruby, Moore	New York	1890	April 27	7 9	9 10	r	r	7 8	6 7	2–8	d k
Saunders	Ontario	1890	May 4	6 30	7 8	r	b	3 4	9 10	2–10	m k
Select. Moore	Massachusetts	1890	April 27	6 20	7 8	r	r	5 6	8 9	2–6	m k
Versaillaise	France	1888	" 27	6 22	8 9	r	r	6 7	8 9	2–6	m k
Victoria	England	1888	May 2	6 22	8 9	r	r	5 6	9 10	2 6	m k
Wales, Prince of	Ontario	1890	" 3	7 14	7 8	r	b	5 6	8 9	2–8	m k
White Dutch	Europe	1888	April 27	7 7	7 8	r	w	10	8 9	2–8	d k
White Gondoin	Europe	1890	" 28	7 11	4 5	r	w	8 9	8 9	2–8	d k
White Grape	Europe	1888	" 29	7 9	6 7	r	w	8 9	7 8	2–6	d k m
Wilder	New York	1890	" 27	7 1	8 9	r	r	6 7	8 9	2–9	m k

Long Bunch Holland is somewhat later than the varieties above mentioned, but seems to have no advantages over them except that it is less injured by the borers. On the other hand, it is very subject to the attack of plant lice, which cause the leaves to roll and take on a dull red color. The fruit is borne on moderately long stems, but the berries are comparatively small. The plants are vigorous and are less injured than most other varieties by currant worms and the leaf-spot diseases.

Lakewood is a vigorous, upright-growing sort that in plant and fruit resembles Cherry. The clusters vary in size, although, as a rule, there is a long stalk between the fruit spurs and the base of the cluster. Although evidently a hardy variety, it has not equaled those above mentioned in productiveness.

London is one of the most promising of the new varieties for either home use or market. The plants are tall, upright or slightly spreading, and are quite healthy and vigorous in growth. The stalk is long and with a comparatively compact cluster of large berries. From the fact that it is less injured by the leaf spot diseases and the twig borers than most other kinds it is a valuable variety for market, although the flavor of the fruit is not equal to that of some of the other varieties.

North Star is a recently introduced variety from Minnesota, which has shown itself quite productive and vigorous in growth. The stalk is medium to long, the clusters moderately compact and the berries of good size. The quality of the fruit is good.

Pomona, a recently introduced variety, has not been sufficiently tested to determine its value, although it has in some sections shown itself to be quite productive. The berries are of medium size and with moderately long stalks and clusters. It is dark red in color, and of high quality, comparing well with Red Dutch. The other red varieties have not differed in behavior from those previously reported. With good care, Red Dutch and Victoria have given excellent results, as they have been less injured by the borer than other varieties. When the bushes are properly pruned and sprayed and have good cultivation, with plenty of fertilizer, the berries compare well with most other varieties, and the quality of the Red Dutch is fully equal to any of the other kinds.

Wilder had again shown itself to be a valuable variety, comparing well in every respect with the other large-fruited kinds.

GOOSEBERRIES.

The treatment of the gooseberries was similar to that given the currants so far as the spraying was concerned, except that they require rather more care in order to control the powdery mildew. The early sprayings with Bordeaux mixture and Paris green were followed with five applications of potassium sulphide, used at the rate of three ounces in ten gallons of water, the first being made upon the 17th of May and the others at intervals of about ten days. For the most part, these later applications were not necessary upon the varieties of American origin, but as the plantation included a large number of European varieties which are very subject to the attack of mildew, in our hot, dry summers, the sprayings mentioned above were for the most part necessary. The expense of the material is comparatively small and the cost of applying it is slight. On the other hand, the benefits were very marked, as, in the case of varieties which when left unsprayed would have lost the entire crop, and at best would have made a weak and unhealthy growth, a large yield of very fine fruit was secured. Many of the varieties averaged from one-fourth to one-third of an ounce in weight for the single fruit. Although grown under exactly the same conditions as the other sorts, for some unknown reason, the kinds that have usually been most productive were least so in 1898, as Downing, Smith, Houghton and Pale Red bore but few fruits, while Keepsake, Apex, Lancashire and others of the European varieties gave good crops. Although slight differences can be detected in both the plant and the shape and color of the fruit, there is a close resemblance between many of the varieties of *Ribes grossularia*, the European gooseberry. Of the varieties under trial, Keepsake and Lancashire have given the best results. The plants are of vigorous growth with stout branches and thick, dark green leaves. The fruit in both cases is large, averaging one-third of an ounce. In Keepsake they are yellowish green, with slight brown cheek on the exposed side, and vary in form from oval to ovate, while those of the Lancashire are of a rather long-oval and are green with a dull red blush. The veins in both cases are quite distinct and of a pale green color. The flavor is mild and pleasant and the juice abundant. Of the other varieties, Auburn, Chautauqua, Columbus, Industry and Triumph gave fairly good results, although they were less productive than those above mentioned. All of these except Triumph are of a yellowish-green, with distinct yellow or yellowish-white veins. Most of them are of a roundish-oval form, but Columbus is nearly spherical. Of the American varieties, Downing has been most commonly grown and is generally successful. Of the new sorts, Pearl and Champion, which have a general resemblance to Downing, seem to have much promise, although in size they are considerably smaller than the European sorts, their weight being less than one-half as much. The general characteristics of the other varieties can be ascertained from the accompanying table and from previous reports.

TABULATION OF GOOSEBERRIES, 1898.

KEY: Form—l, long; o, oval; r, round. Color—g, green; r, red; w, white; y, yellow.

Names.	Species.	Planted.	Bloomed.	Ripened.	Form.	Color.	Weight in oz.	Productiveness—1-10.	Quality—1-10	Vigor—1-10.
Apex	Grossularia	1893	May 1	7 25	o	y g	2-6	8 9	8 9	8 9
Auburn	Grossularia	1890	" 2	7 19	o	g r	2-6	3 4	8 9	5 6
Bendelon	Grossularia	1894	" 3	7 15	o	y g	2-15	2	6 7	8 9
Champion	Grossularia	1891	" 2	7 19	r o	g y	2-18	3 4	5 6	10
Chautauqua	Grossularia	1892	" 2	7 15	r o	g y	2-5	5 6	7 8	8 9
Columbus	Grossularia	1894	" 2	7 11	r	y g	2-5	4 5	9 10	9 10
Downing	Oxyacanthoides	1888	April 27	7 17	r to ro	g y	2-14	1	6 7	10
Golden (Prolific)	Grossularia	1891	May 3	8 1	l o	y	2-6	1-2	6 7	8 9
Houghton	Oxyacanthoides	1888	" 1	7 13	r o	r	2-32	1-2	10	10
Industry	Grossularia	1889	" 1	7 11	r o	r	2-6	3 4	6 7	7 8
Keepsake	Grossularia	1894	" 1	7 11	o	y g	2-4	6 7	8 9	9 10
Lancashire	Grossularia	1894	April 27	7 6	l o	g r	2-6	10	7 8	9 10
Orange	Grossularia	1890	" 27	7 9	r	y g	2-20	2	8 9	10
Pale Red	Oxyacanthoides	1890	May 2	7 9	r o	r	2-44	1 2	9 10	9 10
Pearl	Oxyacanthoides	1890	" 1	7 2	r	g	2-12	3 4	10	8 9
Red Jacket	Oxyacanthoides	1890	" 2	7 20	r o	r	2-12	1-2	7 8	9 10
Smith	Oxyacanthoides	1888	" 1	7 12	o	g	2-22	1	9 10	5
Strubler	Cynosbati	1892	" 2	7 18	o ro	g y	2-12	1	7 8	5
Tree	Cynosbati	1892	" 4	7 25	r o	r	2-24	1-2	5 6	9 10
Triumph	Grossularia	1890	" 2	7 9	o to eo	g y	2-6	3	6 7	8 9

GRAPES.

In 1888 the first planting of grapes was made, and as new varieties could be secured, they have been added, until now the plantation numbers 150 varieties. The vines first planted were trained upon flat-topped trellises with the cross-arms about five feet from the ground. The vines were pruned with two arms in each direction, and frequent renewal has been practiced. The later plantings have been provided with vertical trellises with two wires, the upper one being about six and the lower four and one-half feet from the ground. For the most part, the vines have been trained with four horizontal arms, the pruning and training being after the so-called Kniffin system. From the fact that no variety has been trained after both methods it is rather difficult to judge of the merits of two systems, but the vertical trellises certainly permit of the greater ease in cultivation, and during the past season the crop has been considerably larger than from the vines trained upon the horizontal trellises. On the other hand, the injury from downy mildew and other fungous diseases seems to be rather less upon the flat-topped trellis. The vines were sprayed with Bordeaux mixture before the buds opened, and on the 25th of July they received an application of a weak solution of sulphate of copper (one pound to two hundred and fifty gallons of water) to prevent the attack of powdery mildew and other fungous diseases. During the last week in August, oats were sown between the rows of grapes to provide a winter mulch and they seem well adapted to this purpose.

Alice.—Vines quite vigorous. Clusters rather small, cylindrical; berries rather small, round; dark wine color with a lighter bloom; pulp quite tender, light green, vinous, rich, with plentiful juice, and a slight aroma; seeds few; quality good; season end of September. The vines are as yet quite young and have not shown themselves very productive; otherwise a promising variety.

Bell.—Vines quite vigorous. Clusters of medium size, cylindrical, moderately compact; berries medium size, round, grayish, with a medium white bloom; pulp very tender, green, vinous, rich; juice plentiful; quality good; seeds few; season September to October. It seems quite productive, and except that the clusters are small, has some merit both for table use and market.

Belvidere.—Vines quite vigorous. Cluster medium to large, cylindrical, shouldered, moderately compact; berries medium size, round, black, with a light blue bloom; pulp quite tender, greenish, sweet, with a plentiful juice and a slight aroma; quality fair to good; seeds few; season early September. Quite productive.

Berlin.—A strong-growing hardy variety. Clusters large; berries large, round, greenish, with a slight whitish bloom; pulp tender, translucent, very light green, pleasant, sweet, vinous, with a slight foxiness; juice moderate; seeds few; quality fair to good; season last of September. If sufficiently productive it may prove a valuable white grape for market.

Brighton.—Vines fairly vigorous, shoots medium to long jointed; leaves large, thick, dark green; fairly hardy. Clusters medium to large; long, shouldered, moderately compact; berries medium size, round or slightly ovate; color dark wine, becoming dark purple when fully ripe, bloom thick, light colored; pulp tender, very juicy, greenish-yellow, vinous, rich, excellent, with a slight aromatic flavor; juice plentiful; seeds few; quality very good; season middle of September. Although it does not succeed in all locations, it is in most sections one of the most valuable of the red varieties for home use or market. To insure perfet pollination it should be planted adjacent to other varieties. The berries adhere well to the stems, but are rather tender for long shipment.

Campbell Early.—Vines very vigorous, with a dark green foliage. Clusters large, cylindrical, shouldered; berries large, globular; color black with a beautiful blue bloom; pulp melting, greenish-yellow, rich, sweet and vinous, separating readily from the seeds; juice plentiful, colorless; seeds few; quality very good; season early September. One of the most promising of the new varieties either for home use or market. It seems to be of much promise as a shipping variety, and to be a good keeper.

Chidester No. 3.—Vines strong growers. Clusters oblong, shouldered, loose, large; berries medium size, round, dark, nearly covered with a slight bluish bloom; flesh moderately tender, greenish-white, with a slight aroma; quality quite good; seeds few. Season last of September and first of October. Where sufficiently productive it would be a valuable variety for dessert purposes.

Chidester No. 4.—Vines quite vigorous. Clusters medium size, roundish, shouldered, loose; berries large, round, often covered nearly black, with a plentiful blue bloom; pulp tender, pale green, vinous; juice plentiful; quality quite good; season middle of September.

Colerain.—Vines quite vigorous, with large healthy foliage, quite free from mildew. Clusters large, conical; moderately compact; berries large, round, light green, with a delicate whitish bloom; pulp very tender, light green, very sweet and vinous, with colorless juice; seeds few; quality very good; season middle of September. A promising variety, especially for home use.

TABULATION OF GRAPES, 1898.

ABBREVIATIONS: Bunch: Form—c, compact; cy, cylindrical; r, roundish; s, shouldered. Berry: Form—o, oval; ov, ovate; r, round. Color—a, amber; b, black; g, greenish; p, purple; r, reddish; w, whitish; y, yellowish. Season: b, beginning; m, middle; e, end.

No.	Names.	Species.	Bloomed.	Ripened.	Received from.	Vigor—Scale 1 to 10.	Productiveness—Scale 1 to 10.	Quality—Scale 1 to 10.	Bunch.		Berry.		
									Form.	Weight in ounces.	Form.	Size.	Color.
1	Adirondac	Lab. x Vin.	June 21	m Sept.	Ell. & Barry	6	10	4 5	cy c s	4	r o	3 4	b
2	Agawam	Lab. x Vin.	" 21	b Oct.	Hubbard	10	2	6 7	cy o s	5	r	8 9	p b
3	Alice	Lab.	" 21	b Sept.	T. J. Dwyer	8	4	7 8	cy	3	r	3 4	r
4	Aminia	Lab. x Vin.	" 21	m Sept.	Hubbard	7 8	2	7 8	cy s	5½	r	7 8	b
5	Barry	Lab. x Vin.	" 20	b Oct.	Hubbard	9 10	1	7	r c s	3	r	7 8	b
6	Belvidere	Lab.	" 19	b Sept.	Agricultural College	6 7	9 10	4 5	cy s	5	r	5 6	b
7	Black Eagle	Lab. x Vin.	" 24	m Sept.	Hubbard	6 7	8 9	6 7	cy c s	4	r o	7 8	b
8	Black Pearl	Vul. x Lab.	" 18	m Sept.	Agricultural College	10	3	3 4	cy s	2	r	4 5	b
9	Brighton	Lab. x Vin.	" 23	m Sept.	Hubbard	8 9	4 5	10	cy s	6	r	5 6	p
10	Burnett	Lab. x Vin.	" 21	m Oct.	Ell. & Barry	7	7	7	cy s	5½	r ov	5 6	b
11	Cambridge	Lab.	" 21	m Sept.	Barnhart	7 8	6 7	6 7	cy s	3½	r o	6 7	b
12	Caywood 50	Lab.	" 19	e Sept.	Caywood	8 9	9	3 4	cy s	5	r ov	5 6	b
13	Centennial	Lab. x Vin.	" 25	m Oct.	Campbell	5	10	10	cy s	3	r	3 4	w
14	Challenge	Lab. x Vin.	" 20	m Sept.	Barnhart	9 10	2	3 4	cy s	3	r	3 4	r
15	Chidester 3	Lab.	" 28	b Oct.	Chidester	7	4 5	9	cy s	3	r	3 4	r
16	Chidester 4	Lab.	" 20	m Sept.	Chidester	8 9	2	7 8	r s	4	r	7 8	p
17	Clinton	Vul. x Lab.	" 17	m Sept.	Hubbard	10	7	4	cy s	4	r	4 5	b
18	Colerain	Lab.	" 22	m Sept.	Campbell	6 7	5	8 9	cy s	5½	r	6 7	w
19	Columbia	Vul. x Lab.	" 22	m Oct.	Ell. & Barry	4 5	4	4	r s	6	r ov	7 10	p
20	Columbian	Lab.	" 20	m Sept.	Farmer	7	7	4	r s	5½	r ov	10	p
21	Concord	Lab.	" 21	m Sept.	Home	9 10	5	5 6	cy s	6½	r	6 7	b
22	Cortland	Lab.	" 19	b Sept.	Lambert	9	5	2 3	o s	5½	r	5 6	b
23	Cottage	Lab.	" 20	b Sept.	Hubbard	7 8	7	4 5	cy	4	r	5 6	b
24	Creveling	Lab. x Vin.	" 17	m Sept.	Hubbard	10	4	5	cy	?	r	3 4	b
25	Delaware	Bour. x Lab.	" 20	e Sept.	Hubbard	8	7 8	10	cy c s	3	r	2 3	r
26	Diamond	Lab. x Vin.	" 22	m Sept.	Chase	8	4 5	7 8	cy c s	5½	r	5 6	w
27	Diana	Lab. x Vin.	" 24	b Oct.	Hubbard	7	1	7 8	cy c s	3	r o	5 6	r
28	Downing	Aest. x Vin.	" 29	b Oct.	Hubbard	9	4 5	8 9	cy c s	9	ov	5 6	b
29	Dracut	Lab.	" 21	m Sept.	Hubbard	8 9	3	2 3	cy s	4	r	6 8	a
30	Duchess	Lab. x Vin.	" 25	e Oct.	Hubbard	8 9	3	10	cy c s	7	r ov	3 4	g y
31	Early Victor	Bour. x Lab.	" 21	m Sept.	Hubbard	10	5 6	7 8	cy c s	4	r	4 5	b
32	Eaton	Lab.	" 21	m Sept.	Hubbard	8	5 6	4	cy s	8	r	7 9	b

33	Elaine	Lab. x Vin.	June 21	m e Sept.	Engle	4	1	7 8			r	6 7	r
34	Elvira	Lab. x Vul.	" 20	m Oct.	Hubbard	9 10	10	4 5	cy	5½	r	6 7	y g
35	Empire State	Lab. x Vin.	" 19	m Oct.	Hubbard	8	4	8 9	cy	6½	r	3 4	g
36	Esther	Lab. x Vin.	" 22	b Oct.	Josselyn	7	10	6	cy s	5½	r	6 7	y w
37	Etta	Lab. x Vul.	" 19	b Oct.	Hubbard	7	10	4 5	r s	6	r	6 8	g
38	Eumelan	Lab. x Vin.	" 20	b Oct.	Hubbard	10	7	8	cy s	4	r	5 6	b
39	Faith	Lab. x Vul.	" 20	m Sept.	College	9	3	7 8	cy c s	2	r	1 3	w
40	Geneva	Lab. x Vin.	" 21	b Oct.	Chase	9 10	8	8 9	cy c s	3½	ov	5 6	g w
41	Golden Gem	(Bour. x Lab.) x Vin.	" 19	m Sept.	Campbell	7	7	10	cy s	2	r	3 4	w
42	Goldstein	Lab.	" 20	e August	Thompson	7 8	2	6 7	cy s	5	r	6 7	b
43	Guinevra	Lab. x Vin.	" 21	m Sept.	Engle	7 8	8	6 7	cy c s	6	r	9 10	w
44	Hall	Lab.	" 21	b Sept.	Hall	9 10	4 5	6 7	cy c s	4	r	6 7	b
45	Hartford	Lab.	" 20	m Sept.	Hubbard	8	5 6	3 4	cy c s	4	r	5 6	b
46	Hayes	Lab.	" 20	m Sept.	Hubbard	7	1	6 7	cy s	4	r	3 4	w
47	Herbert	Lab. x Vin.	" 24	m e Sept.	Hubbard	8 9	3	6 7	cy c s	5½	r	7 8	b
48	Honey	Lab. x Vin.	" 21	m e Sept.	Engle	7	10	7 8	cy s	5	r	6 7	g y
49	Hosford	Lab.	" 21	b Sept.	Hosford	7	9 10	5 6	cy s	5½	r	9 10	b
50	Iona	Lab. x Vin.	" 24	m Oct.	Hubbard	9	5	10	cy s	6½	r ov	5 6	r
51	Isabella	Lab. x Vin.?	" 19	b Oct.	Hubbard	10	4 5	8	cy s	4	r ov	6 7	b
52	Ives	Lab.	" 21	b Sept.	Hubbard	9	8 9	3 4	cy s	3	r	5 6	b
53	Jefferson	Lab. x Vin.	" 21	b Oct.	Hubbard	6	7	8 9	r c s	7	r	5 6	r
54	Jessica	Bour. x Lab.	" 20	b m Sept.	Smith	8	7	6	cy c s	3	r	4 5	w
55	Jewell	Bour. x Lab.	" 24	m Sept.	Stayman	8 9	8 9	6 7	cy s	2	r	3 4	b
56	Josselyn 5		" 20	m Sept.	Josselyn	9	10	8 9	cy	4	r	7 8	w
57	Josselyn 7		" 25	b m Sept.	Josselyn	7 8	9	10	cy s	4	r	4 7	g
58	Josselyn 9		" 23	b Oct.	Josselyn	6	10	5 6	cy	4	r	6 8	b
59	Josselyn 10		" 21	b Sept.	Josselyn	4	1	4 5	cy c s	2½	r	5 6	b
60	Lady	Lab.	" 21	b Sept.	Josselyn	6 7	2	6	cy s	4	r	6 7	w
61	Leader	Lab.	" 20	b Oct.	Josselyn	7	6	5 6	cy	3	r	5 7	w
62	Leavenworth	Lab.	" 21	m Sept.	Stayman	9 10	3	6 7	cy s	5	r	6 7	b
63	Lindley	Lab. x Vin.	" 20	e Sept.	Hubbard	8 9	1	8 7	cy s	4	r	5 7	r
64	Lutie	Lab.	" 21	m Sept.	Parry	9	6	3 4	cy	6½	r	7 8	a
65	Lyon		" 20	m e Sept.	Chidester	7 8	9	8 9	cy s	6	r	8 9	w
66	Mason, Mrs.	Lab. x Vin.?	" 20	m e Sept.	Mason	7 8	7	6 7	cy s	3	r	5 6	r
67	Massasoit	Lab. x Vin.	" 21	b Oct.	Hubbard	8	1	6 7	r s	4	r	6 8	r
68	Merrimac	Lab. x Vin.	" 20	b Oct.	Hubbard	9 10	2	7	cy	4	r	8 9	b
69	Michigan	Lab. x Vin.	" 24	m Sept.	Engle	7	1 2	7 8	cy s	3½	r	6 7	w
70	Millington	Lab.	" 20	m Oct.	Palmer	6	6	5	r s	4½	r	6 0	b
71	Mills	Lab. x Vin.	" 23	m Oct.	Ell. & Barry	8 9	5	10	cy s	6	r	5 6	b
72	Minnesota	Lab.?	" 21	m Oct.	Graham	9 10	6	4 5	cy s	4 5	r	4 7	g y
73	Moore Early	Lab.	" 19	e August	Hubbard	8 9	4	5	cy s	9½	r	7 8	b
74	Moyer	Bour. x Lab ?	" 21	e Sept.	Hubbard	9	4	4 5	cy s	3	r	3 4	a
75	Naomi	(Lab. x Vul. x Vin.)	" 17	m e Sept.	Hubbard	9 10	1	3	cy c	4	r o	5 6	g r
76	Oneida	Lab. x Vin.	" 22	m Oct.	Hubbard	7 8	8	6 7	cy s	3½	r	6 8	r
77	Osage	Lab.	" 23	m Sept.	Stayman	7	1	5	r	3¾	r	8 9	b
78	Owosso	Lab.	" 21	m e Sept.	Ell. & Barry	8	9	4 5	cy c s	4	r	6 8	p r
79	Ozark	Æst.	" 25	b Oct.	Stayman	9 10	9 10	4 5	cy c s	6	r	4 6	b

TABULATION OF GRAPES, 1898.—*Concluded.*

No.	Names.	Species.	Bloomed.	Ripened.	Received from.	Vigor—Scale 1 to 10.	Productiveness—Scale 1 to 10.	Quality—Scale 1 to 10.	Bunch.		Berry.		
									Form.	Weight in ounces.	Form.	Size.	Color.
80	Peabody	Vul.	June 21	b Sept.	Campbell	6 7	8	5 6	cy.	5¾	r	5 6	b
81	Perkins	Lab.	" 19	m e Sept.	Hubbard	7	5	2	cy c s	2	r	6 7	r
82	Pocklington	Lab.	" 20	b Oct.	Hubbard	7	3	6 7	cy s	7	r	6 9	w
83	Poughkeepsie	Bour. x Lab.	" 24	b Oct.	Hubbard	4	2	9 10	cy c s	4	r	4 6	r
84	Prentiss	Lab. x Vin.	" 24	m e Sept.	Hubbard	8	2	7 8	cy c	4½	r o	5 7	g w
85	Presley	(Lab. x Vul.) x Lab.	" 19	m e Sept.	Munson	7 8	4	4 5	cy c s	4	r o	5 6	b
86	Progress (Norfolk)	Lab. x Vin.	" 22	b Oct.	Stayman	8 9	8	4 5	cy c s	6	r	5 6	b
87	Rentz	Lab.	" 21	b Oct.	Hubbard	10	1	3 4	r s	------	r	5 6	b
88	Requa	Lab. x Vin.	" 23	m Oct.	Campbell	8	10	7 8	cy c	4	r	6 7	p r
89	Rochester	Lab. x Vin.	" 21	b Oct.	Ell. & Barry	8	9 10	6 7	cy c s	5	r ov	4 5	r
90	Rockwood	Lab.	" 19	m Sept.	Josselyn	7	7	7 8	cy c s	3	r	4 5	b
91	Rogers 5	Lab. x Vin.	" 23	m e Sept.	Hubbard	7	1	7	r	------	r	7	r
92	Rogers 24	Lab. x Vin.	" 20	b Sept.	Hubbard	6 7	1	6 7	r c s	5	r	6 7	r
93	Rogers 30	Lab. x Vin.	" 22	m Sept.	Hubbard	7	1	5	r s	3	r	5 8	b
94	Salem	Lab. x Vin.	" 19	b Oct.	Hubbard	7 8	3	5 6	r s	4	r	7 10	p
95	Secretary	(Lab. x Vul.) x Vin.	" 20	m Oct.	Ell. & Barry	4 5	4 5	8	cy c s	7	ov	4 6	b
96	Telegraph	Lab.	" 20	b Sept.	Hubbard	7	10	5	cy c s	4 5	r	6 7	b
97	Themis (incorrect)	Lab. x Vin.	" 22	m Sept.	Engle	7 8	8	5 6	cy s	5½	r	6 7	b
98	Triumph	Lab. x Vin.	" 25	m Oct.	Campbell	7 8	10	8 9	cy c s	10	r ov	7 8	g y
99	Ulster	Lab. x Vin.	" 20	m Oct.	Caywood	4 5	4 5	9 10	cy c	4½	r	6 7	r
100	Vergennes	Lab.	" 20	m Sept.	Hubbard	6	8 9	8 9	cy s	4	o	7 8	r
101	Vesta	Lab. x Vin.	" 24	m Oct.	Engle	7	4	3 4	r	3	r	7 8	g
102	Victoria	Lab.	" 23	b Oct.	Josselyn	7	9	6	cy s	9½	r	5 6	b
103	Warder	Lab.	" 21	b Sept.	Huber	5 6	1	3 4	cy s	7	r	4	b
104	Washington *Lady*	Lab. x Vin.	" 24	b Oct.	Hubbard	6 7	1	6 7	cy s	4	r	5 6	y w
105	Wells?	Æst. Hybr.	" 20	b m Oct.	Robards	8 9	9 10	1 2	cy s	6½	r ov	7 8	r
106	White Ann Arbor	Lab.	" 20	m e Oct.	Scott	7	1	6 7	cy s	3	r	4 5	w
107	White Beauty	Lab. x Vin.?	" 23	m e Sept.	Stayman	7	10	7 8	cy s	3½	r	4 6	w y
108	White Imperial	Lab. x Vin.?	" 23	m Sept.	Stayman	7	9	7 8	cy c s	2	r	5 6	w
109	Wilder	Lab. x Vin.	" 20	b Oct.	Hubbard	6 7	3	7 8	r c s	4	r	8 9	b
110	Willis	Bour. x Lab.?	" 20	m Sept.	Campbell	7	9	5 6	cy s	2½	r	5 6	w
111	Winchell	Lab. x Vin.	" 21	b Sept.	Ell. & Barry	7	2	9 10	cy c s	4	r	5 6	g w
112	Witt	Lab. x Vin.	" 23	m e Sept.	Campbell	9 10	1	7 8	r s	------	r	5 9	g y
113	Woodruff	Lab. x Vin.	" 20	b Oct.	Scott	9 10	2 3	6	r s	3	r	7 8	r
114	Worden	Lab.	" 20	m e Sept.	Hubbard	10	4 5	7 8	cy s	6	r	7 8	b
115	Wyoming	Lab.	" 20	m Sept.	Hubbard	8	4	4	cy s	3	r	5 6	r

Columbian.—Vines very vigorous, strong-growing, with large, thick, leathery leaves. Clusters medium to large, roundish, shoulders, loose; berries very large, roundish, oblate, reddish purple, with a plentiful bloom; pulp half tender, greenish, acid; quality rather poor; seeds quite numerous; season middle of September. Fairly productive. Aside from the strength of the vine it seems to have little value, either as a variety for home use or market.

Concord.—Vines quite vigorous, hardy and healthy. Clusters large, cylindrical, shouldered, moderately compact; berries good size, round, black, with a plentiful blue bloom; pulp half tender, greenish, vinous, sprightly, with colorless juice, and a moderate aroma; seeds few, large; season middle of September. Generally quite productive and a reliable variety for all sections.

Cortland.—Vines very vigorous. Clusters medium size, somewhat shouldered, rather loose; berries medium-sized, round, black with a light blue bloom; pulp very tender, greenish, with a plentiful juice, very foxy; quality poor; season early September. Fairly productive. The quality is so poor that it seems to be worthless.

Cottage.—Vines quite vigorous, with large, leathery leaves. Clusters medium size, cylindrical, moderately compact; berries medium to large, round, black, with a light blue bloom; pulp rather tough, yellowish, not very juicy, foxy; seeds few. large; quality fair; season early September. Berries drop from the clusters soon after picking. Less valuable than Concord and Worden.

Delaware.—Vines rather short, slender; growth short jointed; quite hardy. Clusters medium size, nearly cylindrical, shouldered, very compact; berries small, round, wine colored, becoming quite dark when fully ripe, with a bluish bloom; pulp tender, yellowish, or very light amber, very juicy, vinous, rich, sprightly, excellent quality very good; seeds few; season middle to last of September. In favorable locations it is quite productive, and its high quality makes it one of the most valuable grapes for eitner home use or market.

Diana.—Vines quite strong. Clusters medium sized, short, cylindrical, very compact; berries medium to large, roundish-oval, reddish-lilac, or light wine color, with a plentiful blue bloom; pulp rather tough, whitish, vinous, pleasant, with a foxy aroma at first which soon disappears; seeds few, rather large; quality good; season early October. Generally quite productive, but it ripens too late to succeed in most sections. Its principal value exists in its keeping qualities, which make it possible to preserve the fruit until spring.

Downing.—Vines quite vigorous. Clusters large to very large, long, conical slightly shouldered, quite compact; berries medium to large, long, oval, black, with a very slight blue bloom; pulp tender, greenish-amber, with a moderate amount of juice; skin thick, but rather tender; seeds large, generally but one; quality quite good. Season late September or early October. Quite productive, and unusually free from mildew. Although rather late, it has some value on account of its long-keeping qualities.

Duchess.—Vines very vigorous, but with moderately short jointed shoots. Clusters medium to large, long, conical, shouldered, quite compact; berries small, roundish-oval, light green to pale greenish-yellow, dotted with diminutive brown specks; bloom slight, whitish, almost transparent; when fully ripe the berries sometimes take on a golden yellow color; pulp tender, breaking, greenish, sweet, vinous, rich, spicy; juice moderate; seeds few; quality very good. Season early October. Generally quite productive.

Early Victor.—Vines hardy, wood dark gray, rather long jointed; foliage healthy, thick, medium size, dark green, deeply lobed. Clusters small, oblong, conical, shouldered, moderately compact; berries rather small, round, black, with a medium bluish bloom; pulp rather firm, greenish-white, vinous, rather rich, pleasant, with a plentiful juice; seeds medium, quality quite good; generally quite productive. Season middle of September. Clusters rather small to make it desirable as a market variety, but its hardiness, productiveness and high quality make it valuable for home use.

Eaton.—Vines vigorous, strong and hardy, with large leaves. Clusters large, cylindrical, shouldered, quite compact: berries large, round, black, with a dense blue bloom; pulp half tender, green, hardy, vinous, very juicy; seeds few; quality fair. Season middle of September: fairly producive. Although the fruit is large and handsome, it is inferior to Concord in flavor and seems to have no merits over that variety.

Empire State.—Vines quite vigorous. Clusters large, cylindrical, shouldered, quite compact; berries medium size, round, light green, with a thick white bloom;

pulp tender, very light green, vinous, pleasant; seeds few; quality quite good. Somewhat lacking in productiveness in many sections, but where it succeeds it is a valuable table grape. Season early October.

Esther.—Vines vigorous, quite healthy. Clusters medium size, cylindrical, moderately compact; berries large, round, golden yellow, with a whitish, nearly transparent bloom; pulp rather tough, yellowish-green, vinous, rich; juice colorless, not very plentiful; seeds few; quality fair; last of September or first of October; quite productive.

Geneva.—Vines quite vigorous, strong-growing, healthy. Clusters medium size, cylindrical, loose; berries medium to large, obovate to oval, white or greenish-white, with a slight white bloom; pulp half tender, translucent when fully ripe, greenish white, sweet, vinous, with an abundant colorless juice and a slight aroma; seeds quite numerous; quality good; fairly productive. Season early October. A valuable white variety for home use or market.

Golden Gem.—Vines somewhat lacking in vigor; wood short-jointed, leaves slightly separate, small to medium in size. Cluster small, cylindrical, shouldered, moderately compact; berries small, round, of a rich golden color, with a delicate white bloom; pulp half tender, light green; juice plentiful, colorless, very sweet; quality very good; fairly productive; seeds numerous, quite small. Season middle of September. Of no value for market, but on account of its high quality and handsome appearance, it is worthy of trial for home use.

Goldstein.—Vines quite vigorous. Clusters medium size, short, cylindrical, shouldered, moderately compact; berries rather large, round, black with a thick bloom; pulp tender, light amber, pleasant, with colorless juice, and a slight foxy taste; quality good. Season last of August. The vines are small, and thus far have not shown any indications of productiveness.

Hayes.—Vines quite vigorous, hardy, free from mildew, with short-jointed wood. Clusters medium size, cylindrical, shouldered; berries small, round, yellowish-amber, with a dense whitish bloom; pulp rather tough, light green, mild, rich, vinous, with an abundant colorless juice and a slight aroma; quality good, seeds few. Season middle of September. Generally lacking in productiveness.

Herbert.—Vines quite vigorous and among the hardiest of Rogers' seedlings. Clusters medium to large, roundish, shouldered, moderately compact; berries large, round, black, with a dense blue bloom; pulp tender, greenish, sweet, pleasant, sprightly, with a plentiful juice; seeds few, large; quality good. Season middle of September. Usually quite productive. Valuable for home use and one of the best of the black varieties sent out by Rogers, for market.

Honey.—Vines moderately vigorous, short-jointed, hardy. Clusters medium size, cylindrical, shouldered, moderately compact; berries large, round, greenish-yellow, with a slight whitish bloom; pulp rather tender, almost translucent, green, sweet, vinous, juicy, and a slight foxy aroma; seeds few, large; quality good; quite productive. A valuable dessert variety. Season middle of September.

Hosford.—Vines strong and hardy. Clusters large and conical, shouldered, moderately compact; berries large to very large, round, black, with a medium blue bloom; pulp tender, greenish, sprightly, vinous, with a plentiful colorless juice; seeds quite numerous, large; quality good; generally quite prolific. Season early to middle of September. A promising sort either for home use or market.

Janesville.—Vine, very vigorous, hardy and healthy. Clusters medium to large, short, shouldered, very compact; berries medium to large, round, black, with a slight blue bloom; pulp moderately tender, greenish, highly vinous, juicy; seeds generally numerous, large; quality rather poor. Of value only on account of its hardiness and vigor.

Jefferson.—Vines fairly vigorous, wood rather short-jointed; leaves large, thick and downy. Clusters large, short, shouldered, moderately compact; berries medium size, round, black, wine-colored, with a slight blue bloom; pulp very tender, light amber, sprightly, vinous; seeds quite large, rather numerous; quality very good; generally productive. Especially valuable for home use on account of its high flavor and its long-keeping qualities. Season late September or early October.

Jessica.—Vines fairly vigorous. Clusters of medium size, cylindrical, shouldered, moderately compact; berries medium to large, round, white to golden-yellow, with a slight whitish bloom; pulp tender, green, very sweet and pleasant; juice plentiful, seeds few and large for the size of the berry; quality good. A hardy and fairly productive variety of some merit for home use. Season first to middle of September.

Jewell.—Vines moderately vigorous. Clusters small, cylindrical, shouldered, moderately compact; berries small, round, black, with blue bloom; pulp rather tough, whitish, vinous, sprightly and juicy; seeds numerous; quality good; season first to middle of September. While fairly productive and of good quality, the clusters are rather small.

Josselyn No. 5.—Vines very vigorous. Clusters medium size, cylindrical, moderately compact; berries rather large, round, white, with a thin white bloom; pulp rather tender, yellowish-green, sweet, slightly acid; quality very good; seeds numerous. Season early October. A fairly productive variety for home use or market. Apparently a hybrid between *vinifera* and *labrusca.*

Josselyn No. 7.—Vines very strong. Clusters medium to large, cylindrical, shouldered; berries medium to large, round, pale green, with a light white bloom; pulp half tender, pale green, vinous, rather rich, with abundant juice; seeds small and few; season early October; quality very good; quite productive. A promising table grape, although it seems subject to the attack of mildew when unsprayed.

Josselyn No. 9-2-1.—Vines quite vigorous. Clusters medium size, cylindrical, moderately compact; berries rather large, roundish, black with a plentiful blue bloom; pulp tender, light green, vinous, sprightly, with a plentiful colorless juice; seeds few. As yet somewhat lacking in productiveness, and likely to shell from the stems as soon as ripe.

Josselyn No. 10.—Somewhat lacking in vigor. Clusters small, cylindrical, shouldered, rather loose; berries medium to large, roundish, black with a thin bloom; pulp rather tough, light amber, sprightly, rather rich, with a plentiful juice and slight aroma; seeds few; quality fair. As yet somewhat lacking in productiveness. Season last of August and first of September.

Lady.—Vines rather slow growing and slender, but hardy. Clusters medium size, oblong, somewhat conical and slightly shouldered, quite compact; berries medium to large, round, white or greenish-yellow, with a slight whitish bloom; pulp tender, whitish, vinous, with an abundance of juice and slight aroma; seeds few, small quality good, season early September; fairly productive. A variety of some value for home use.

Leader.—Vines rather vigorous. Clusters medium size, cylindrical loose; berries medium to large, round, white, with a thin, whitish bloom; pulp firm, light green, vinous, sprightly, with a plentiful colorless juice, and a musky aroma; seeds few; quality fair. The vines as yet have not given indications of their productiveness.

Lindley.—Vines fairly strong, but with rather long-jointed, slender canes, and with few laterals. Clusters rather small, long, shouldered, loose; berries medium to large, round, brick-red, with a lilac bloom; pulp rather tender, greenish, vinous, very pleasant, juicy; seeds few, large; season middle of September; generally fairly productive; quality good. A valuable variety for dessert purposes.

Lutie.—Vines rather strong. Clusters medium size, long, cylindrical, very compact; berries large, round, pale to dark red, with a very thin bloom; pulp half tender, whitish, with colorless juice and foxy aroma; seeds few; quality poor; season middle of September. Somewhat lacking in productiveness, and hardly likely to become of value.

Lyon.—A seedling originated by C. P. Chidester, Battle Creek, Mich. Vines very strong. Clusters medium to large, cylindrical, shouldered and moderately compact; berries quite large, round, white, with a moderate whitish bloom; pulp quite tender, greenish, sweet, rich and vinous, with an abundance of colorless juice; seeds few; quality very good; season last of September. A fairly productive and promising white grape for either home use or market.

Mason.—Vines quite strong. Clusters medium size, cylindrical, occasionally shouldered and moderately compact; berries medium to large, round, light winecolor, with a medium whitish bloom; pulp half tender, light green, sweet, vinous, sprightly, not very juicy, aroma slight; quality good; seeds few; season middle of September; fairly productive. The vines were sent for trial from Ottawa county, and while it appears to be a promising variety, further time is required to test it properly.

Michigan.—Vines quite vigorous and hardy. Clusters medium size, cylindrical, shouldered, quite compact; berries large, round, pale green, with a thin whitish bloom; pulp half tender, green, moderately juicy and with a slight aroma; seeds few; quality very good. A promising variety for dessert purposes. Season middle of September.

Millington.—Vines fairly vigorous. Clusters good size, roundish, shouldered, moderately compact; berries medium to large, round, black, with a blue bloom;

pulp tender, very light green, quite sprightly, sweet, vinous, very juicy, with a perceptible aroma; seeds few; quality fair to good; moderately productive; season middle of September.

Mills.—Vines quite strong and vigorous. Clusters large, long, shouldered, moderately compact; skin tough, thick, a good keeper; berries medium to large, round, black, with a light blue bloom; pulp tender, light green, vinous, rich, with a medium juice; quality very good; seeds few; season early October; fairly productive. A promising variety for home use on account of its high flavor and long keeping qualities.

Monroe.—Vines fairly vigorous and hard, with firm, short-jointed wood. Clusters medium size, long, shouldered, loose; berries medium to large, roundish, oval, black, with a thin bluish-white bloom; pulp tender, light green, sweet, sub-acid, very juicy, seeds few; quality fair to good; season early October; fairly productive, promising for market purposes.

Moore *Early.*—Vines rather strong. Clusters medium size, generally roundish, conical, rarely shouldered, moderately compact; berries large, round black, with a thin bloom; pulp rather firm, greenish, slightly vinous, quite juicy, with a slight foxy odor; seeds few; season early September; fairly productive. Although the clusters are rather small, and the berries soon drop from the stems, it is one of the best of the early black varieties.

Moyer.—Vines fairly vigorous, but of a slender growth, young wood short-jointed; clusters small, cylindrical, shouldered, loose; berries small, round, dark wine color, with a dull grayish bloom; pulp tender, greenish, sweet, pleasant, vinous, very juicy; seeds few; quality fair to good; season early September; inferior in productiveness and quality to Delaware, which it somewhat resembles, but a hardy variety and one that would succeed where the other would fail.

Naomi.—Vines quite strong. Clusters rather small, cylindrical, shouldered, short; berries medium to large, roundish-oval, black with a whitish bloom; pulp tender, juicy, greenish, tinged with red, highly vinous, with a plentiful juice and moderate aroma; seeds few; quality fair; season middle of September. Somewhat lacking in productiveness.

Niagara.—Vines quite vigorous, hardy and healthy, with long-jointed stems, and large, thick, leathery, downy foliage. Clusters quite large, conical, shouldered, moderately compact; berries large, round or slightly elongated, greenish or yellowish white, with a slight whitish bloom; pulp half tender, greenish-white, vinous, sprightly, quite juicy; seeds numerous, rather large; quality good. Although it does not thrive equally well in all localities, it is one of the most valuable of the white varieties for home use or market purposes.

Northern Light.—Vines rather strong. Clusters cylindrical, slightly shouldered, moderately compact; berries medium to large, round, greenish-white, with a thin whitish bloom; pulp half tender, greenish, mild, vinous, rich, very pleasant, with a medium amount of juice; the rather small seeds separate readily from the pulp; seeds few; quality good; ripe last of September. A promising variety if it proves sufficiently productive.

Olita.—Vines moderately vigorous. Clusters small, cylindrical, shouldered, moderately compact; berries medium to large, roundish; color greenish, with a slight whitish bloom; pulp very tender, pale, very sweet and pleasant, and with considerable juice; quality good; seeds few. A weak growth of the vines was probably due to an attack of mildew, to which they seem somewhat subject. Although the fruit has some merit as a table variety, the small size of the clusters will prevent it from being used as a market sort. Season last of September.

Oneida.—Vines fairly strong. Clusters small, cylindrical, shouldered, moderately compact; berries rather large, round, light wine colored, with a beautiful lilac bloom; pulp very tender, whitish, sweet and pleasant, juicy; seeds few; quality good; season early October; quite productive. A handsome and rather productive sort that may prove valuable for home use.

Osage.—Vines fairly strong and apparently hardy. Clusters medium size, oval, moderately compact; berries large, round, black, with a medium blue bloom; pulp rather tough, greenish, sweet, sprightly, with an abundant juice and foxy aroma; seeds few, rather large; quality fair; season early October. Not likely to be worthy of extensive planting.

Owosso.—Vines very vigorous. Clusters medium to large, round, shouldered, moderately compact; berries large, round, reddish-purple, with a slight lilac bloom; pulp tough, yellowish-white, highly vinous, with a plentiful colorless juice; seeds few, large; quality rather poor; season middle of September; only moderately productive. Of little value even as a market sort.

Ozark.—Vines quite strong and hardy. Clusters large, cylindrical, shouldered, moderately compact; berries medium size, round, black, with a light blue bloom; pulp tender, meaty, greenish, vinous, not very juicy; seeds numerous, large; quality rather poor; moderately productive; season middle of October, which makes it rather late for this climate.

Peabody.—Vines hardy and rather strong; clusters medium size, cylindrical, fairly compact; berries medium to large, oval, black with a medium blue bloom; pulp tender, greenish, acid, with a plentiful juice; seeds rather few; quality fair; season middle of September; fairly productive. Not likely to become generally valuable.

Perkins.—Vines quite strong and healthy, with leathery leaves. Clusters small, conical, shouldered, fairly compact; berries medium to large, round, lilac or pale amber, with a thin whitish bloom; pulp tough, yellowish, moderately juicy, very foxy; quality poor; seeds numerous; season early October; fairly productive, but of too poor quality for any purpose.

Pocklington.—Vines quite strong and vigorous, with pubescent leathery leaves. Clusters large, cylindrical, shouldered, quite compact; berries medium to large, round, golden yellow, with a whitish bloom; pulp tender, yellowish, with a medium colorless juice and slight foxy aroma; seeds few, rather large; quality good, fairly productive; season early October. In some sections highly esteemed as a variety for either home use or market.

Poughkeepsie.—Vines are weak and feeble in their growth. Clusters medium size, cylindrical, shouldered, very compact; berries medium, round, wine-colored, with a slight lilac bloom; pulp very tender, yellowish-green, vinous, sprightly, with a plentiful colorless juice; seeds few, small; quality quite good. While it is ordinarily quite productive, the lack of vigor in the vines, and the small size of the clusters make it of little value. Season early October.

Prentiss.—Vines fairly vigorous, with rather short-jointed wood. Clusters large, cylindrical, very compact; berries medium to large, roundish-oval, yellowish or greenish white, with a slight white bloom; pulp half tender, light green, vinous, rich, with a medium amount of juice and a slight foxy aroma; seeds few; quality quite good; season early October; quite productive. A long-keeping variety that has some merit for home use.

Presley.—Vines quite vigorous. Clusters small to medium, cylindrical, shouldered, quite compact; berries medium to large, roundish, oval, dark wine-colored, with a light blue bloom; pulp tender, yellowish, nearly sweet, with a moderate amount of juice; seeds few; quality fair to good; quite productive. Although of rather low quality, the vigor and productiveness of the vines may make it of some value for market purposes. Season middle of September.

Rentz.—Fairly vigorous and healthy. Clusters medium size, shouldered; berries medium to large, round, dense black, with little or no bloom; pulp half tender, translucent, whitish, with a sweet, vinous flavor, and considerable colorless juice and foxy aroma; seeds numerous, large; quality rather poor; season middle of September. The berries drop from the vines as soon as they are ripe. A southern wine grape that is out of place in Michigan.

Requa.—Vines moderately vigorous. Clusters large, cylindrical, shouldered, moderately compact; berries large, round, wine-colored, with a thick bluish bloom; pulp half tender, greenish, sweet, sprightly, with abundant colorless juice; seeds few; quality quite good. As it is only moderately productive, it is not likely to take the place of some of the older kinds.

Rochester.—Vines fairly vigorous and hardy, with short-jointed wood and large foliage. Clusters large, short, conical, shouldered, very compact; berries medium size, roundish-oval to ovate, reddish-purple, with a slight white bloom; pulp half tender, greenish, sweet, vinous, rich, with a plentiful colorless juice; seeds few; quality good; only moderately productive; season middle of September.

Rockwood.—Vines fairly vigorous. Clusters medium size, long, shouldered, moderately compact; berries medium to large, round, black, with a dense blue bloom; pulp tender, greenish, vinous, rich, with an abundant juice; quality quite good.

Salem.—Vines quite strong and healthy, with large foliage. Clusters medium size, roundish, shouldered, compact; berries large to very large, round, dark chestnut, with a slight blue bloom; pulp half tender, greenish-yellow, vinous, sprightly, with a medium amount of juice and a slight aroma; seeds few; quality good. Although somewhat lacking in productiveness the past year, it is generally regarded as one of the best of Rogers' hybrids. Season middle of September.

Secretary.—Vines moderately vigorous. Clusters small to medium, conical, slightly cylindrical, shouldered; berries medium to large, oval, black, with blue bloom; pulp firm and breaking, light amber, slightly vinous, with a moderate amount of juice; seeds medium size, few; quality good; fairly productive. From its liability to mildew, it has been considered an unprofitable variety.

Telegraph.—Vines rather strong. Clusters large to very large, cylindrical, shouldered, very compact; berries medium to large, round to oval, black, with bluish bloom; pulp tough, white, sprightly, highly vinous, juice abundant, aroma slight; seeds few; quality fair; quite productive; season early September. The low quality of the variety and its tough pulp make it of little value even for market purposes.

Triumph.—Vines quite vigorous. Clusters very lirge, long, cylindrical, shouldered and moderately compact; berries large, roundish-oval, pale green or golden yellow, with a delicate whitish bloom; pulp tender, transparent, delicate, very juicy, bright green, rich and vinous; seeds few; quality quite good; rather productive; season middle of October. A valuable variety, either for market of dessert purposes, where it can be ripened, but rather late for most parts of Michigan.

Ulster.—Vines fairly strong, short-jointed, with a thick, leathery foliage. Clusters medium to large, cylindrical, compact; berries large, round, red, with a slight bluish bloom; pulp tender, greenish, vinous, rich; seeds few; quality very good; rather productive; season early October. Although not likely to be generally valuable for market, its high quality makes it desirable for home use.

Vergennes.—Vines hardy, moderately vigorous and healthy, with large, downy leaves. Clusters medium to large, long, slightly shouldered, rather compact; berries large, oval, amber to red, with a medium grayish bloom; pulp tender, greenish, vinous, pleasant, rich, with a fair amount of juice; seeds few; quality good; season last of September; quite productive. Valuable for home use on account of its long keeping qualities.

Victoria.—Vines quite vigorous. Clusters large, cylindrical, shouldered, moderately compact; berries medium to large, roundish-ovate, white, with a slight whitish bloom; pulp half tender, greenish, sweet, vinous, rather rich, quite juicy and with a foxy aroma; seeds few, large; quality good; fairly productive; season middle of September.

Warder.—Vines rather weak, but healthy. Clusters medium size, cylindrical, shouldered; berries medium to large, round, black, with a slight bluish bloom; pulp tender, yellowish-green, mild, vinous, with a plentiful colorless juice and a foxy aroma; seeds few; quality rather poor; only moderately productive; season early October. Seems to have no value.

Washington *Lady*.—Vines rather strong, with short jointed shoots; leaves large roundish, coarsely serrate, occasionally lobed. Clusters large, long broad, often doubly shouldered; berries medium to large, round, yellowish-white, with a thin whitish bloom; pulp tender, greenish, vinous, sprightly, moderately juicy; seeds few, rather large; quality good; season early October. Somewhat lacking in productiveness, but a valuable grape in some sections for home use.

Wells.—Vines fairly vigorous. Clusters large cylindrical, shouldered, moderately compact; berries large, roundish-oval, wine-colored, with a plentiful bloom; pulp tender, green, mild, with a peculiar unpleasant flavor, very juicy and with a foxy and disagreeable aroma; seeds numerous; quality very poor; season first of October; quite productive. The very poor quality of the variety unfits it for any use.

White Beauty.—Vines vigorous, with thick healthy foliage. Clusters medium size, cylindrical, shouldered, quite compact; berries medium size, round, white or golden yellow, with a light whitish bloom; pulp tender, greenish, sweet and vinous, with a plentiful colorless juice; seeds few; quality good; ripe last of September. Valuable for dessert purposes, if at all.

White Imperial.—Vines quite vigorous. Clusters small, cylindrical, shouldered, moderately compact; berries medium size, round, white, with a plentiful white bloom; pulp half-tender, greenish, spicy, sweet, pleasant, with a plentiful juice; seeds few, small; flavor quite good; season last of September. It bears some resemblance to White Beauty.

Wilder.—Vines vigorous, fairly hardy, but subject to attack of mildew. Clusters large, conical, shouldered; berries large, round, black, with a light blue bloom; pulp half tender, pale amber, vinous, pleasant; seeds few, large; quality quite good; season early October. A valuable variety for home use.

Willis.—Vines quite vigorous. Clusters medium size, prominently shouldered, very compact, pale green or amber-yellow, with a slight bloom; pulp very tender, pale greenish, slightly vinous, very juicy, with a slight foxy aroma; seeds medium in number, large; quality good; season early September; generally quite productive. Of possible value as a market variety.

Winchell.—Vines quite vigorous. Clusters medium to large, long, shouldered, moderately compact, color greenish-white, with a slight bloom; pulp rather tender, green, sweet, rich, quite juicy; seeds few, medium size; quality very good; season early September; quite productive. The best early white grape for home use or market purposes; It also holds its quality well after maturity, Green Mountain is identical with this variety.

Witt.—Vines quite vigorous hardy and healthy. Clusters medium size conical, shouldered; berries medium to large, roundish, greenish-white or yellow at maturity, with a thin whitish bloom; pulp very tender, yellowish, sweet and vinous, with an abundant juice and a slight aroma; seeds few; quality quite good; season last of September.

Woodruff.—Vines quite strong-growing. Clusters medium size, roundish, shouldered, quite compact; berries large, round, red, with a thin whitish bloom; pulp rather firm, whitish, mild, sweet and vinous, with a plentiful colorless juice and a foxy aroma; seeds few; quality fair; moderately productive; season last of September or first of October. Although it succeeds well in some places, it cannot be generally recommended for market, as it is quite variable in quality and the bunches are frequently quite small or imperfect.

Worden.—Vines quite vigorous. Clusters large, long, shouldered; berries round, black, with a thin blue bloom; pulp moderately firm, greenish-white, vinous, pleasant, with a plentiful juice; seeds few; quality quite good; season early September; quite productive. Nearly a week later than Concord, and hence more desirable than that variety for the northern part of the State, and on account of its superior quality, it is everywhere preferred to the Concord for home use or local market.

Wyoming *Red.*—Vines vigorous, healthy and hardy. Clusters rather small, cylindrical, shouldered, moderately compact; berries medium size, round, dark wine color, with an abundant whitish bloom; pulp moderately firm, yellowish, sprightly, with a colorless juice and very foxy; seeds few; quality rather poor; season middle of September. Although it is quite hardy, and hence of some merit for the northern part of the State, yet its poor quality renders it undesirable where better kinds can be grown.

APPLES.

In addition to the spraying with copper sulphate solution, before the buds started, the trees were sprayed with Bordeaux mixture, after the flower buds had appeared, but before they opened, for the prevention of scab. This treatment is of even more value than those made either earlier or later, as the fruit stalks are particularly subject to the attack of the apple scab fungus, and if the conditions at the time of blossoming favor the development of the disease, the crop is often destroyed, but if the trees are sprayed just before the flowers open, the attack can be prevented. On June 2, another spraying with Bordeaux mixture and Paris green was given the trees for the destruction of the larvae of the codling moth as well as for preventing the scab. Other sprayings were made upon the 20th of June and upon the 22nd of July. On June 4th the presence of the woolly aphis being detected upon some of the trees, they were sprayed with kerosene emulsion, and wood ashes were later on scattered about the trees at the rate of one bushel per tree. Although a large number of the varieties were old enough to give a fair crop, comparatively few of the trees blossomed. The following are descriptions of the varieties that fruited this year:

Battullen.—Trees spreading and of vigorous growth; the fruit which ripened the latter part of October, weighed five and one-half ounces; form roundish, oblate, with a deep, slightly irregular basin, and a narrow, deep and regular cavity; stalk one inch long and of medium size; calyx slightly open; segments long, reflexed and woolly; calyx tube long, funnel shaped; color clear yellow, with a carmine blush and marblings and blotches of russet and clear green on a yellow ground; dots numerous and oblong, brown; flesh whitish, very juicy, tender, with a sprightly, acid flavor; quality good. This promises to be one of the best of the late-keeping winter varieties, and if sufficiently productive, will be a valuable kind for market in sections where hardiness is of importance.

Borovinka.—Trees vigorous, rather upright, with quite strong shoots, of a dark olive brown, quite downy; fruit roundish, oblate, with an average weight of eight ounces; ripe August 10; cavity broad and deep, slightly corrugated; stalk stout, seven-eighths of an inch long; basin broad, shallow, with a large conical calyx tube, and with a large and nearly closed calyx of which the segments are long and the tips reflexed; core medium, closed; flesh white, juicy and of a brisk, sub-acid flavor; texture tender, breaking, rather coarse; color pale red, washed with dull red in the sun and conspicuously striped with darker red when fully exposed. In tree and fruit much like Oldenburg, but it may prove to be a distinct and productive culinary variety. Season September.

Bottle Greening.—Tree quite vigorous, spreading; fruit large, oblate, inclined to conic; basin medium, slightly corrugated; cavity broad and deep; calyx small and closed; color greenish-yellow, shaded with dull crimson in the sun, and thinly sprinkled with light dots and specks; core small; flesh white, tender, sub-acid, almost melting. Season January to February.

Bradford's Best.—Tree quite vigorous and of an upright habit; fruit large, roundish, slightly conical, with a deep, narrow and abrupt cavity and a narrow, abrupt and corrugated basin; stalk of medium size, three-fourths to one inch line; calyx small, closed; calyx tube large, funnel shaped; color greenish, washed, dappled and sparingly striped with dull, purplish red and specked and dotted with russet, thickly sprinkled with large, irregular dots, having gray centers. Season December to March.

Canada Baldwin.—Tree very vigorous, upright with spreading branches; fruit large, oblate, slightly angular; cavity deep, slightly irregular and rather large; basin large, deep and corrugated; stalk one-half to three-fourths inches long, slender; color whitish, thickly striped and splashed with rich red and crimson, purplish crimson where fully exposed and having a slight bloom and many regular, pinkish dots and specks; calyx closed or slightly open, small; calyx tube long, funnel shaped; flesh very white, juicy, mild, sub-acid and a quince-like flavor; core medium, open; seeds plump, pointed; quality good, valuable for desert or market purposes. Season December to April.

Cogswell.—Trees quite vigorous, upright rather spreading; fruit large, roundish, conical, somewhat oblate; cavity broad, deep, acute with a brownish russet; basin very narrow, shallow, corrugated; stalk one-half to one-inch in length, medium size; calyx irregular, nearly closed; calyx tube conical; color pale ylelow, mostly covered with red, striped and dappled with darker red and sometimes more or less overspread with rough, brownish russet, with many dots and specks, increasing towards the eye; flesh white, moderately juicy; aromatic, mild, sub-acid, rich, crisp, tender, fine grained. Season November to March.

Cornell.—Tree a strong, upright grower; fruit medium size, roundish, conical, with a deep, acute, regular cavity and a narrow, abrupt, shallow and flat basin; stalk one and one-eighth inches long, slender; color yellow, with a pale red blush over most of the surface, and with broken stripes of darker red and faint marblings of russet; calyx open; calyx tube short, conical; flesh white, moderately juicy; core compact; seeds few; flavor mild, sub-acid; texture tender, fine grained. Season September.

Gano.—A very vigorous growing tree, with a roundish head; fruit conical, some what ribbed; cavity broad, deep, ribbed, grayish brown; basin narrow, abrupt, corrugated; stalk three-fourths inch long, stout; calyx with short erect segments, generally slightly open; calyx tube funnel shaped; color yellow, nearly covered with dull red, splashed and briskly striped with darker red; core slightly open, small; seeds roundish, ovate, plump; flesh a faint yellowish white; sprightly, sub-acid, crisp, tender, juicy. Season October to March.

TABULATION OF APPLES—1898.

Pyrus Malus.

ABBREVIATIONS—Month: b, beginning; e, end; m, middle. Form: c, conical; i, irregular; o, oblate; ob, oblong; ov, ovate; r, roundish. Color, g, green; r, red; ru, russet; s, striped; w, white; y, yellow. Texture: c, crisp; d, dry; f, firm; j, juicy; t, tender. Flavor, a, acid; m, mild; s, sweet. Use: c, cider; d, dessert; k, kitchen; m, market.

No.	Names.	Origin.	Planted.	Vigor.	Bloomed.	Ripe.	Season.	Weight in ounces.	Form.	Color.	Texture.	Flavor.	Quality—Scale 1 to 10.	Use.
1	Babbitt	Missouri?	1890	8	May 14	e Oct.	Nov. Dec.?	7	o ro ov c	y r s ru	f c j	a	5 6	m k
2	Bailey *Sweet*	New York ?	1888	8	" 19	b m Oct.	Nov. Mar.	9	r	r	t	s	8 9	d k m
3	Battullen	Russia	1888	10	" 19	e Oct.	Nov. Mar.?	5.33	r o	y g r ru	t	a	6 7	m d k
4	Borovinka	Russia	1888	8	" 12	e Aug.	Sept.	8	r o	y r s	c j t	a	5 6	k m
5	Bottle Greening	Vermont	1890	10	" 16	Oct.	Jan. Feb.	8	o c	y r	t	m	6 7	d
6	Bough	America	1888	9 10	" 16	e Aug.	Sept.	4.5	r c	y	t j	s	9 10	d k
7	Bradford	Tennessee	1890	8	" 16	Nov.	Dec. Mar.	4 5	r c	g r s ru	t c	m	4	m
8	Canada Baldwin	Quebec	1890	10	" 16	e Oct.	Dec. Mar.	5	o	w r s	t	m	6 7	d m
9	Chenango	New York	1888	9 10	" 18	e Aug.	Aug. Sept.	4	ob c	y rs	t j	m	8	d m
10	Clayton		1892	10		e Oct.	Dec. Dec.?	4.5	o	g rs	t	m	3 4 ?	m
11	Cogswell	Connecticut	1888	9 10	" 19	m Sept.	Nov. Mar.	8	rc o	y rs	t j	m	5	d m
12	Colton	Ohio ?	1888	8 9	" 13	Aug.	Aug.	5	o c i	g y	f j	m	6	d m
13	Cornell	Pennsylvania	1890	8	" 17	m Sept.	Sept.	4	r c	y s ru	t j	m	7	d
14	Day	Nebraska	1891	9	" 16	e Sept.	Oct. m Nov.	7	r c	y ru	f t	m	3 4	m
15	Dyer	France ?	1888	7	" 14	m Sept.	Sept. Oct.	5	r o	y ru	t j	m	9 10	d k
16	Fink	Ohio	1892	8 9	" 18	Oct.	Dec. Dec.	4	o	y r s	f	m	4 5	m
17	Gano	Missouri	1890	9 10	" 16	b Nov.	Oct. May	6	o c i	y r s	c t j	m	5	k m
18	Garden Royal	Massachusetts	1888	9 10	" 17	m Sept.	Sept. Oct.	3 75	ro c	g y r s	t j	m	10	d
19	Gideon	Minnesota	1890	10	" 14	b Sept.	Sept. Jan.	5.5	r c	y r	f c	m a	5	k m
20	Gill		1892	.9	" 19	e Oct.	Oct. Apr. ?	9 25	r o	y r ru	f	m	4 5	m
21	Gloege	Wisconsin	1888	7 8	" 13	Nov.	Dec. Mar.	6.5	ov ob	y ru	c	m	4	m
22	Golden Russet, N. Y.	England	1888	10	" 13	Dec.	Dec. Apr.	5 5	r o	y ru	f j	m	7 8	d m
23	Grimes	Virginia	1890	9	" 16	Dec.	Dec. Mar.	6	r ob	y	c t	m	8 9	d m
24	Grosh	Pennsylvania	1890	8	" 17	m Sept.	Sept. Oct.	7	r o	gy r s	c	m	7 9	k m
25	Haas	Missouri	1892	7 8	" 16	b Sept.	Sept. Oct.	5	o c	g y r s	t	m	5 6	m
26	Hagenkopt	Europe	1888	10		b m Sept.	Sept.	6 5	r ov	y r s	f	a	5	m
27	Hubbardston	Massachusetts	1888	9	" 15	m Nov.	Nov. Feb.	8	r o c	y r s	t j	m	8 9	d m
28	Indian ?	America	1892	10	" 19	m Sept.	Sept. Jan.	6	r o c	y r ru	f c	m	4 5	m
29	Iowa *Keeper*	Iowa	1891	9 10	" 17	Dec.	Dec.	5,33	o	g y r	f	m	4 5	m
30	Jefferis	Pennsylvania	1888	9 10	" 19	e Aug.	m e Sept.	5,75	r o c	y r s	t j	m	10	d m

TABULATION OF CRAB APPLES, 1898.

Pyrus baccata; including actual and supposed hybrids.

ABBREVIATIONS—Month: b, beginning; e, end; m, middle. Form: c, conical; i, irregular; o, oblate; ob, oblong; ov, ovate; r, roundish. Color: g, green; r, red; ru, russet; s, striped; w, white; y, yellow. Texture: c, crisp; d, dry; f, firm; j, juicy; t, tender. Flavor: a, acid; m, mild; s, sweet. Use: c, cider; d, dessert; k, kitchen; m, market.

No.	Names.	Orgin.	Planted.	Vigor.	Bloomed.	Ripe.	Season.	Weight in ounces.	Form.	Color.	Texture.	Flavor.	Quality—Scale 1 to 10.	Use.
31	Jersey *Sweet*	New Jersey ?	1888	9	May 17	b Sept.	Sept. b Oct.	5	r c	y r s	t j	s	5 6	d k
32	Jonathan	New York	1888	7 8	" 18	m Nov.	Nov. Mar.	6	r c	y r	c t j	m	10	d k m
33	Keswick	England	1888	7 8	" 15	e Aug.	Aug. Sept.	8	r ov	y r u	c	a	5	k m
34	Kirkland	New York	1890	7 8	" 6	e Oct.	Dec. May	4.5	ro o	g y ru	t c	m	7 8	d m ?
35	Longfield	Russia	1892	8 9	" 13	e Sept.	Sept. Oct.	6	r c	g y ru	c t	m	5	m k
36	Louise	Ontario	1890	9	" 16	b Nov.	Nov. Jan.	6	r o	y r	t c	m	7 8	d m
37	Lowell	America ?	1890	9 10	" 14	b Sept.	Sept. Oct.	7.5	r ob	y	t j	m	7 8	k m
38	Loy	America	1890	8	" 19	Oct.	Nov. Jan.?	6.5	o	g y r s	f c	a	5 6	k m
39	Maiden Blush	New Jersey	1888	9	" 18	m Oct.	e Aug. e Oct.	6	o	y r	t	m	6 7	k d
40	Marmalade	Europe	1888	7 8	" 15	e Aug.	Sept. Oct.	4.5	r ob i	y r s	c t	s	3 4	?
41	Mason *Orange*	Missouri ?	1890	8 9	" 19	Nov.	Nov. Jan.	8.5	r o	y	c t j	m	5 6	m k
42	Minkler	Illinois ?	1892	8	" 14	Jan.	Jan. Mar.	6	r c	g y r	f j	m	6 7	m
43	Nero	America ?	1890	9	" 16	e Oct.	Jan. May ?	5.5	ro o	y r ru	f c j	m	6 7?	m d
44	Northfield	Vermont	1890	9	" 15	m Sept.	Sept. Dec.	8.5	r o	y r s ru	c t	m	5	k
45	Oakland	Michigan	1888	8	" 13	e Oct.	Nov. Mar.	6	o	y r s	t j	m	7 8	d m
46	Oldenburg	Russia	1892	8	" 12	m Aug.	Sept.	7.75	o	y r	c	a	4 5	k m
47	Ontario	Ontario	1890	9	" 18	Jan.	Jan. Apr.	8.5	o	w y r s	t j	m	6 7	k m
48	Primate	America	1888	10	" 15	m Aug.	Aug. Oct.	5	r c	y r	t j	a	9	d m
49	Pryor Red *Seedling*	Illinois ?	1888	9	" 16	e Oct.	Jan. Mar. ?	7	r o	g y r ru	t	m	5 6	m
50	Quince *Cole*	America ?	1892	9 10	" 16	b Sept.	Sept.	6	r c	y	c t	a	4 5	k m
51	Red Aport ?	Russia	1888	10	" 14	b m Sept.	Sept. m Nov.	9.5	o c	y r s	t j	m	5	k
52	Red June	Carolina ?	1892	9 10	" 21	m Aug.	Aug.	4.25	ov c	r	t j	m	7 8	d
53	Rhode Island	Rhode Island	1888	9 10	" 16	Oct.	Dec. Mar.	8	r o	g y	t c	a	7 9	d k m
54	Ribston	England	1888	8	" 13	m Sept.	Nov. Apr.	5.5	r	y r ru	f c	a	7 8	d k
55	Roxbury	Massachusetts	1888	10	" 16	Jan.	Jan. June	6	r o	y ru	f j	m	7 8	k m
56	Scarlet Cranberry	America	1891	8 9	" 16	Oct.	Dec. Apr.	6	o	g y r s	f j	m	5	m ?
57	Sheriff	Pennsylvania	1891	8	" 16	Oct	Oct. Mar.	7	r o c	g r s	t	m	7	m d
58	Stark	Ohio ?	1888	9	" 15	Jan.	Dec. May	10	r ob c	g y r s	f c	m	4 5	m
59	Stuart ?		1894	9	" 19	Oct.	Dec. May	4	r o	g y r	c t	a	5 6	?
60	Stump	New York	1890	9 10	" 16	e Aug	Aug. Sept.	4.33	r c	w r	t j	m	7 8	d m

61	Summer Pearmain	America ?	1888	8 9	" 19	b Sept.	Sept.	5	o c	y r ru	t j	m	10	d
62	Summer Rose	America ?	1892	9	" 18	b Aug.	Aug.	4	o	y w r s	t j	m	8	d
63	Thaler ?	Russia	1888	10	" 16	m Aug.	Sept.	5	ob	y r	c t	m	5	k
64	Thornton	America ?	1892	8 9		Oct.	Nov.	4.5	r ov	g y r ru	f j	m	4 6	m
65	Titovka	Russia	1888	7	" 14	m Aug.	Sept.	7	o c i	y r s	c j	m	5 6	k m
66	Talman	Rhode Island	1888	9	" 19	e Oct.	Oct. Mar.	6	r o	y r	f	s	8	k
67	Washington Strawberry	New York	1890	8 9	" 13	b Sept.	Sept.	8	o c	y r s	c t	m	7 8	m
68	Water	Pennsylvania	1890	8 9	" 18	Oct.	Oct. Nov.	4.5	r ov c	y r	t j	m	5	d m
69	Wealthy	Minnesota	1890	8	" 16	b Sept.	Sept b Nov.	6	r o	y r s	f	m	6	m d
70	Winter Streifling	Russia	1888	10	" 14	b Sept.	Sept.	8	r o	y r s	t j	m	4 5	k m
71	Yellow Transparent	Russia	1888	9 10	" 17	b Aug.	Aug.	6.33	ov c	y	t j	a	3 4	k m
72	York Imperial	Pennsylvania	1892	9 10	" 19	Oct.	Nov. Feb.	4.5	o	y r s	f c j	m	5 6	d m
73	Zolotoreff	Russia	1890	8	" 16	e Aug.	Aug.	9	r	y r	f c	a	3 5	m k
74	Zuzoff	Russia	1890	9	" 13	b Sept.	Sept Oct.	4	r c	y r	t j	m	3 4	k m ?
1	August	Minnesota	1890	8	May 13	Aug. 19	m Sept.	4	r c	y r	c	a	3 4	k
2	Dartmouth	Massachusetts	1890	10	" 14	" 15	e Aug. b Sept.	1.5	o	r	c j	m	10	d m
3	Excelsior	Minnesota	1890	9	" 16	" 25	e Aug.	3	r o	y r	t j	a	6	k m
4	Florence	Minnesota	1890	8	" 13	" 25	b Sept.	1.5	o	y r	t j	a	6 7	k m
5	Jelly	Minnesota	1890	10	" 13	e Sept.	b Oct.	2	o ob c	y r	c j	a	5	k
6	Lou	Minnesota	1890	9	" 13	m Aug.	Sept.	5	r ov	y r	c t j	a	4 6	k m
7	Martha	Minnesota	1890	7 8	" 14	m Aug.	Sept. Oct.	3	o	y r	c j	m	9 10	k m
8	North Star	Minnesota	1891	7 8	" 11	m Aug.	Aug.	1.5	r o	y r	c t	m	4 5	k
9	No. 1 New	Minnesota	1890	9 10	" 19	m Aug.	m Aug.	9	r ob	y r	t j	a	7 8	d m k
10	No. 2 New	Minnesota	1890	9 10	" 11	m Sept.	Sept.	4.5	o c	y r s	t j	a	5	m
11	October	Minnesota	1890	8	" 14	e Aug.	Aug. Sept.	4	r	y r	t j	a	5	k m
12	Peter	Minnesota	1890	8 9	" 15	Sept. 9	Sept.	5	o c	y r	t j	a	5 6	k
13	Whitney	Illinois	1890	10	" 10	Aug. 22	e Aug.	3	r ob	y r	c	m	8 9	d m

Gideon.—One of the most valuable of the seedlings grown by Peter Gideon, of Minnesota. Tree quite vigorous with an upright, spreading, but rather slender growth. Fruit medium to large, roundish, slightly conical, with a deep, acute and uneven cavity; stalk one to one and three-fourths inches long, rather slender; basin narrow, shallow, much plaited, and with a small, closed calyx; calyx tube conical; color clear, light yellow, generally with a blush, and occasionally irregularly marked with patches of russet, with a few dark spots and many almost obscure light dots and specks; flesh white, firm, crisp and juicy, with a sub-acid and something of a crab-like flavor; core rather large, open; seeds many, large. Season fall and early winter. A promising variety for cooking purposes, especially in sections where hardiness is necessary.

Gill.—Tree vigorous with a roundish head. Fruit quite large, roundish, oblate, and slightly conical; cavity deep, abrupt, slightly irregular; stalk three-fourths inches long, moderately stout; basin medium, slightly corrugated; calyx of medium size, open, with short, erect segments; calyx tube funnel-shaped, small; flesh white, moderately juicy, firm, with a mild sub-acid flavor; color light greenish-yellow, with a dark red blush and indistinct stripes, much flecked with cinnamon russet, and with a sprinkling of light brown dots and specks, more frequent toward the cavity, which is much russeted; core medium, open; seeds plump, ovate. Season November to March. It promises to be a valuable market variety, if sufficiently productive.

Gloege.—Tree moderately vigorous, and of a roundish, upright form. Fruit ovate, inclined to oblong; cavity deep, acute; stalk one-half to three-fourths inches long, rather stout; basin narrow, ribbed, moderately deep; calyx partially open, segments upright, with tips recurved; calyx tube conical; color yellow with much cinnamon in stripes and patches, especially towards the stem, and quite thickly sprinkled with brown dots; core rather large, closed; flesh white, crisp and juicy, moderately tender and with a mild, sub acid flavor. Season December to March. Said to be very hardy in Wisconsin.

Grosh.—Trees moderately vigorous, upright, spreading. Fruit large, roundish oblate, regular; cavity broad, moderately deep; stalk one-fourth inch long, fleshy; basin narrow, moderately deep, ribbed; calyx small, closed; calyx tube small, slightly funnel-shaped; color greenish-yellow, striped and splashed with red; flesh whitish, firm, crisp, moderately juicy, with a mild, sprightly, sub-acid flavor; core medium, open; seeds plump. Season September and October. An early and annual bearer, and if as the trees become older they prove productive, it seems to be a valuable variety either for dessert or cooking purposes.

Haas.—A strong growing, upright tree, forming a beautiful and symmetrical head. Fruit large, oblate, slightly conical, angular or ribbed; cavity medium, a little greenish; stalk three-fourths inch long, small; basin small or medium, slightly corrugated; calyx small, closed; calyx tube funnel-shaped; color pale, greenish-yellow, shaded nearly over the whole surface with light and dark red and with rather obscure splashes and stripes, and a few light dots; flesh white, juicy, fine grain and tender; flavor brisk, sub-acid; core medium to large. Season September and October. A valuable market variety on account of its extreme hardiness.

Hagenkopt.—Tree very vigorous, spreading. Fruit roundish ovate; cavity small, moderately deep; stalk one-half inch long, stout; basin shallow, much corrugated; calyx small, closed; calyx tube funnel-shaped; color yellow, slightly washed and broken in stripes with light red; flesh creamy white, very juicy, but with a firm texture; flavor vinous. Season September and October.

Hubbardston.—Trees quite vigorous, forming a handsome, branching head. Fruit roundish, inclining to conical or ovate; cavity broad, deep, russeted; stalk five-eighths inch long, rather slender; basin narrow, rather abrupt, and irregularly corrugated; calyx open; calyx tube conical; color yellow, mostly overspread and indistinctly striped with red patches and with tracings of yellowish-russet and with russet dots and specks; core round, closed; flesh yellowish white, juicy, firm, crisp and tender; flavor rich, mild, sub-acid. Season December to February. A very valuable variety either for market or home use. Although it seldom reaches so large a size, in 1897 a single specimen weighed fourteen and three-fourths ounces.

Indian.—Tree quite vigorous and upright in habit. Fruit large, roundish oblate, conical, cavity narrow, deep; stalk three-fourths inch long, stout; basin narrow, shallow, corrugated; calyx nearly closed; calyx tube funnel-shaped; color yellow, striped and mottled with very dark red and russet, with numerous regular yellow dots and specks more frequently toward the eye; flesh creamy white, juicy, firm and crisp; flavor sub-acid. Season October to January. It seems to be a productive sort and may prove of some value for market purposes, although it is of rather low quality for home use.

Iowa Keeper.—A very vigorous, upright growing tree. Fruit oblate, with a narrow, acute cavity, russeted about the stalk, which is slender and one-fourth of an inch long; basin medium, ribbed, knobbed or plaited; calyx closed or partially open; calyx tube large, funnel-shaped; color greenish-yellow, blushed with dark red and with many light specks; core small, nearly closed; seeds medium in number; flesh white or greenish-white near the surface, and with a very firm texture and moderately juicy; flavor mild and sub-acid. Season December to March.

Jefferis.—Tree of moderate growth, roundish, spreading. Fruit of medium size, roundish oblate, conical, with a broad, deep and slightly russeted cavity; stalk medium, one-half inch long; basin abrupt, deep, smooth, regular; calyx medium, closed; calyx tube conical; color yellow, striped with dark, rich red; flesh crisp, tender, juicy, almost melting, with a mild, sub-acid, rich, excellent flavor. Season middle of September. Core small and compact. Its high quality makes it especially desirable for home planting or for local markets, but it is rather tender for long shipments.

Jersey Sweet.—Tree vigorous with a roundish head. Fruit of medium size, roundish, conical, with a deep, narrow, irregular cavity; stalk one-half inch long; basin narrow, abrupt, irregular, corrugated; calyx closed; calyx tube very long, funnel-shaped; color two shades of red, striped with yellowish-green and with many greenish specks; core slightly open; seeds ovate, pointed; flesh yellowish-white, coarse, crisp and tender, but not very juicy; flavor sweet, rich. Season September to October. A valuable fall, sweet variety for dessert or culinary purposes.

Jonathan.—Tree quite vigorous, of an upright habit, but with drooping branches; young shoots are slender, pendulous, greyish-brown. Fruit of medium size, roundish conical, with a rather deep cavity, sometimes plaited and russeted; stalk one inch long, medium size; basin narrow, rather deep, plaited; calyx nearly or quite closed, segments erect; calyx tube nearly conical, slightly funnel-shaped; color clear, light yellow, nearly covered with bright red, shaded into rich, dark red, with frequent, conspicuous light yellow dots and specks; core closed; seeds few, ovate; flesh white, occasionally stained with red near the surface; flavor sprightly, vinous, sub-acid; texture crisp, tender, juicy. Season from November to February. A valuable variety for home use or market purposes, on account of its attractive appearance and high quality.

Keswick *Codlin*.—Thee vigorous, upright, somewhat spreading. Fruit medium to large, inclined to ovate, ribbed at the apex; cavity rather broad, shallow, plaited; stalk one-half inch long, stout; basin shallow, narrow, much corrugated; calyx small, closed, with very long, partially reflexed segments; calyx tube conical; color greenish-yellow, or clear yellow when mature, brownish russet in the cavity; flesh white, crisp, juicy, with large open core; flavor acid. Season August and September. Seeds small, many of them abortive. An early and profuse bearer, so much so that unless carefully pruned and thinned, the trees are short-lived. Valuable for culinary purposes, from the fact that the fruit can be used for cooking purposes some weeks before it is ripe, and in this way the season can be extended for some months.

Kirkland.—Tree vigorous. Fruit roundish oblate, occasionally oblate; cavity moderately deep, abrupt and regular; stalk three-fourths to one inch long; basin broad, shallow, corrugated; calyx medium, open; calyx tube short, funnel-shaped; color varying from clear, light yellow, nearly overspread with light cinnamon russet, to greenish-yellow, with very dark russet; flesh yellowish white, green next to the skin; texture crisp; flavor sprightly, sub-acid, pleasant. Season December to March. A promising variety for dessert or cooking purposes, if the trees prove sufficiently productive.

Longfield.—A vigorous, spreading tree, with the young wood of a dark brown. Fruit of medium size, roundish conical, with a narrow, deep cavity; stalk three-fourths to one inch in length, slender; basin narrow, deep, abrupt, plaited; calyx large, closed, with rather long segments; calyx tube funnel-shaped; color pale yellow, with a pink, or brownish-red cheek, and a very few dark specks and netting of light crimson russet; core small, closed; seeds large, plump, ovate; flesh white, moderately juicy, crisp and tender, with a pleasant, sprightly, sub-acid flavor. Season October to November. A very handsome and quite productive variety that is promising on account of its extreme hardiness, as a culinary variety for home use or market purposes.

Lou.—Tree vigorous, upright. Fruit medium to large, roundish, ovate, with a narrow, deep, regular cavity; stalk one-half inch long, stout; basin very irregular, narrow, shallow, corrugated; calyx large, closed; calyx tube roundish obtuse, conical; color yellow, with broken stripes of dark red upon golden brown in the sun; bloom light, whitish; core large, open; seeds many, ovate, plump; flesh yellowish white, juicy, crisp, tender, sprightly, sub-acid. Season August to September. Young wood dark brown; foliage large, waved, downy. A hardy variety that may prove valuable for culinary and market purposes.

Louise, *Princess Louise.*—A strong-growing, upright tree. Fruit of medium size, roundish oblate, with a medium sized acute cavity; stalk three-fourths inch long, rather slender; basin broad, rather shallow, corrugated; calyx nearly closed, segments reflexed; basin deep, funnel-shaped; color greenish-white, with a deep reddish-brown blush and nearly obscure greenish dots and specks; flesh white, very tender and crisp, but not very juicy; flavor aromatic, mild, very pleasant. Season November to January. A promising variety for home use as a dessert fruit, and if it proves productive, likely to become a valuable market variety.

Magog.—A vigorous-growing, upright tree. Fruit roundish, occasionally remotely ovate, with a broad, deep and irregularly plaited cavity; stalk one inch long, medium; basin varying from medium to broad, moderately deep and abrupt, corrugated; calyx small, closed; calyx tube long-conical, or funnel-shaped; color light yellow, shaded and faintly striped and splashed with light red over one-half the fruit; flesh creamy white, tender, not very juicy; flavor sub-acid, not pleasant. Season November to February. Although of rather poor quality, its extreme hardiness may make it a valuable variety for the northern portion of the State.

Loy.—Tree moderately vigorous, upright. Fruit large, oblate, regular, with a moderately deep, russeted cavity; stalk three-fourths inch long, slender; basin medium, plaited; cavity medium, open, segments reflexed; calyx tube long, cylindrical; color greenish-yellow, nearly covered with a dark, rich red and with obscure stripes and numerous dots and irregular specks; core medium, closed; seeds plump, ovate; flesh whitish, juicy, plump and crisp; flavor mild, acid. Not sufficiently tested to determine its productiveness, but if not lacking in this respect, it may prove a valuable variety for market purposes. Season November to February.

Marmalade.—Tree moderately vigorous spreading. Fruit medium size, roundish oblate, irregular; cavity deep, regular, plaited; stalk one-half to three-fourths inch long, stout; basin deep, abrupt; calyx large, slightly open, segments large; reflexed; calyx tube conical; color yellow, marbled and striped with two shades of red; core large, open; seeds ovate, plump; flesh creamy white, not very juicy, sweet; texture rather coarse, crisp. An early bearer and quite productive variety that may be valuable for home use. Season September to October.

Martha.—Tree rather vigorous and of an upright growth while young. Fruit rather large for a crab, oblate, with a broad, russeted cavity; stalk one inch long, slender; basin shallow, broad; calyx open, segments long, fully reflexed; calyx tube funnel-shaped; color yellow, nearly or quite overspread with bright red, with many yellowish specks and a thin pinkish bloom; flesh pale yellowish white, with a high sprightly flavor; texture crisp, breaking, tender; quality quite good.

Mason *Orange.*—Tree quite vigorous and rather spreading. Fruit roundish oblate, ribbed; cavity broad, deep, irregular, with a little grayish russet; stalk one inch; basin narrow, shallow, much corrugated; calyx small, nearly closed; calyx tube slightly funnel-shaped; color yellow at maturity, with a faint pinkish brown cheek and a few grayish dots and specks; flesh yellowish white, juicy, crisp, tender, sub-acid; quality fair. Season November to January; size large. Young wood yellowish brown, foliage nearly flat, oval, pointed; core large, open; seeds ovate, plump.

McIntosh.—Tree rather vigorous, with a spreading head. Fruit roundish oblate, regular; cavity medium; stalk rather small; basin medium, rather shallow, slightly ribbed; calyx small, nearly closed, segments erect; calyx tube long, funnel-shaped; color whitish yellow, nearly covered with dark, rich red or crimson, almost purplish in the sun, and moderately sprinkled with light dots; flesh white, fine grained, juicy, very tender; flavor mild, sub-acid, refreshing, peculiar; core medium, open; seeds plump, ovate; season November to February; size medium; quality quite good. A hardy and generally productive variety, promising for dessert and market purposes.

Munson.—Tree rather vigorous, spreading. Fruit oblate, cavity large, deep, regular; stalk rather short, medium size; basin small to medium, shallow, corrugated; calyx closed, segments long, reflexed; calyx tube tubular; color pale yellow, sometimes blushed with many almost obscure whitish specks; flesh yellowish, juicy, crisp, tender, sweet; quality fair. Season October; size medium.

Nero.—Rather strong with a spreading head. Fruit roundish oblate; cavity narrow, deep, regular, russeted; stalk one-half inch long, medium; basin very broad, saucer-shaped, ribbed; calyx large, open, segments long; calyx tube short, funnel-shaped; color clear yellow, nearly covered with dull red, deepening into dark red, with patches and marblings of russet, sprinkled with a few large, roundish dots, with grayish centers; flesh whitish, juicy, firm, crisp, with a mild, sub-acid, slightly aromatic flavor; quality good. Season January to April; size large.

No. 1 New.—A seedling from Peter Gideon of Minnesota. Tree quite vigorous, with a roundish head. Fruit roundish, inclining to oblong; cavity narrow, abrupt, russeted, corrugated; stalk one-half inch long, stout; basin medium, corrugated, deep; calyx small, closed; calyx tube conical; color grayish yellow, beautifully spotted and stained with two shades of bright red, with numerous grayish dots and specks; flesh white, not very juicy, rather coarse, crisp, tender, with a sprightly, sub-acid, pleasant flavor; quality quite good. Season September; size large. Its size, handsome appearance and quality make it a promising variety for either home use or market.

No. 2. New.—A seedling from Peter Gideon. Tree quite vigorous, upright, spreading; young wood olive-colored. Fruit oblong, conical; cavity broad, deep, with a few rays of grayish russet; stalk one to one and one-fourth inches long, slender; basin rather broad, shallow, plaited; calyx large, closed, segments erect or occasionally reflexed; calyx tube short, conical; color greenish yellow, partially washed and faintly striped with bright red and with many whitish specks; core medium, open; seeds many, ovate, plump; flesh white, very tender, moderately juicy, and with a high sub-acid flavor; quality fair to good. Season September; size medium to large. An early bearing and fairly productive variety, which has some promise as a culinary fruit.

Northfield.—Tree rather vigorous, with a roundish head. Fruit roundish oblate, sides unequal; cavity broad, moderately deep, slightly russeted; stalk one inch long, rather stout; basin wide, abrupt, moderately deep, corrugated; calyx medium, nearly closed; calyx tube long, funnel-shaped; color whitish-yellow, blushed and faintly striped with red and netted more or less with russet; flesh juicy, crisp, tender, mild, sub-acid; core medium, closed; quality rather poor; size large. Season September to December.

North Star (Crab).—Tree upright, spreading. Fruit roundish oblate; cavity of moderate size, regular, corrugated, russeted; stalk one-half inch long, medium, inclined; basin shallow, corrugated; calyx medium, closed; calyx tube cylindrical; color pale yellow, nearly overspread with bright red in the sun and with many yellowish specks; flesh creamy white, tender, breaking, sub-acid. Season August; size rather small; quality fair.

Oakland.—Tree fairly vigorous, with slender, spreading branches; young wood dark brown. Fruit oblate, nearly regular; cavity broad, moderately deep, with a little dark gray russet; stalk medium size, one-half inch long; basin rather broad, deep, slightly plaited; calyx closed; calyx tube nearly tubular; color yellow, nearly covered with pale red, distinctly striped and splashed with darker red; flesh white, juicy, fine grained, very tender, mild, sub-acid, with a rich, pleasant flavor. Season November to February; quality quite good; size medium to large.

October (Crab.)—Tree fairly strong, spreading. Fruit nearly round, tapering slightly to the eye; cavity rather narrow, deep; stalk rather stout, seven-eighths inch long; basin small, irregular; plaited; calyx large, closed; segments long, erect or slightly reflexed; calyx tube large, long, funnel-shaped; color bright red, with a few obscure stripes, pale yellow when grown in the shade; flesh white, crisp, tender, juicy, sharp, sub-acid. Season August and September; size medium to large for a crab. A promising variety if it proves sufficiently productive.

Oldenburg, *Duchess*.—Tree fairly vigorous, rather upright, but with slender, drooping branches; young wood dark reddish brown. Fruit oblate; cavity broad, deep stalk one-half inch long, stout; basin deep, slightly corrugated; calyx closed; calyx tube funnel-shaped; color pale yellow, washed and distinctly striped and splashed with light and dark red; flesh white, juicy, crisp, but a little coarse, acid; core closed; quality good. Season August and September; size large. A hardy and generally very productive tree.

Ontario.—A strong growing, upright tree with spreading branches. Fruit oblate, slightly conical and frequently angular; cavity broad, deep, irregular, slightly russeted; stalk three-fourths to one inch long, stout; basin broad, deep, slightly corrugated; calyx small, closed or nearly so; calyx tube funnel-shaped; color whitish yellow, with a red cheek, and a few whitish dots and specks; flesh whitish, juicy, tender, brisk, sub-acid; core small, closed; seeds many, large, ovate. Season January to March; size large; quality good; quite productive. A promising variety, particularly for home use.

Peter.—Tree quite vigorous, upright with spreading branches; young wood stout, reddish brown. Fruit oblate, inclining to conic; cavity broad, deep, sometimes with much cinnamon russet; stalk one inch long, rather slender; basin deep, abrupt, slightly plaited; calyx small nearly closed; calyx tube slightly funnel-shaped; color dark red, yellow in the shade, surface covered with a few light-yellowish specks, more numerous towards the crown; flesh white, tender, juicy, with a sprightly, pleasant, sub-acid flavor; core medium, closed; seeds few, large, ovate, pointed. Season October; size large; quality good; generally quite productive. This appears to be a hardy and productive variety, and promising either for market or home use.

Quaker (Crab).—Quite vigorous, tree spreading with a round head. Fruit roundish, slightly ovate; cavity narrow, deep; stalk slender, rather long; basin narrow, deep, plaited; calyx closed, segments rather long with tips slightly reflexed; calyx tube conical; color yellow with a brownish red blush where exposed and with a few indistinct whitish specks; flesh white, moderately juicy, fine grained, crisp, mild, sub-acid; seeds few, small. Season October to November; quality good; size medium.

Quince, *Cole.*—Tree quite vigorous, very upright. Fruit roundish, remotely conical, slightly ribbed; cavity broad, with rays of brownish russet; stalk one-half inch long, medium size; basin narrow, ribbed; calyx closed; calyx tube conical; color yellow, with a few dark specks; flesh whitish, juicy, crisp, tender, sharp, sub-acid; core medium, closed; seeds few, plump. Season August and September; quality medium; size medium to large. A valuable variety for cooking purposes.

Red Aport.—Tree quite vigorous with an upright growth and spreading branches. Fruit oblate, conical, regular; cavity broad, deep, with light gray russet; stalk quite long and very stout; basin narrow, deep, abrupt, plaited; calyx open, segments upright, tips reflexed; calyx tube long, conical; color yellow, washed and obscurely striped with two shades of red, with russet dots and rays of russet extending from the cavity; young wood dark grayish brown; foliage cupped; flesh white, juicy, crisp, a little coarse, sub-acid. Season October and November; quality good; size quite large.

Rosenhager.—Tree quite vigorous, with a roundish head. Fruit round, regular, slightly oblate-conical; cavity narrow, deep, with faint whitish-gray russet; stalk three-fourths inch long, of medium size; basin broad, rather deep, corrugated; calyx large, nearly closed; calyx tube long, funnel-shaped, remotely tubular; color green or yellow when matured, with dark brownish red cheek, overspread, or faintly striped, with dark red, with numerous light gray spots and specks; flesh greenish white, juicy, crisp, rather tender, with an acid flavor; core open with large, long, pointed seeds; quality medium. Season October to November; size quite large.

Scarlet Cranberry.—Tree rather vigorous, spreading. Fruit oblate; cavity deep, regular; stalk short and slender; basin broad, shallow, corrugated; calyx small, open, with erect segments; calyx tube broad, funnel-shaped; color greenish yellow, washed and remotely striped with dull, dark red, and nearly overspread with greenish irregular dots and specks; flesh whitish, slightly veined, firm and juicy, with a slightly sub-acid flavor; quality fair. Season December to February; size medium to large.

Sheriff.—Tree quite strong with spreading branches. Fruit roundish, inclining to oblong, conical; cavity narrow, rather deep; stalk one inch long, rather slender; basin narrow, shallow, plaited; calyx closed or partly open; calyx tube funnel-shaped; color greenish, nearly overspread and faintly striped with dark red, springled with small, light specks; flesh white, moderately juicy, fine-grained, tender, with a mild sub-acid flavor; core medium, closed; quality good; size medium to large. Season October to February. A handsome apple of good quality that is likely to prove valuable if sufficiently productive.

Somerset, *New York.*—Tree rather strong, upright. Fruit conical, slightly ribbed; cavity broad with dense cinnamon russet; stalk seven-eighths of an inch long; medium size; basin small, slightly plaited; calyx large, open; calyx tube conical; color yellow, netted and spotted with grayish russet; flesh yellowish-white, moderately juicy, tender, very sprightly and of quite high flavor. Season August to September; size medium. An early bearer and a valuable variety for eating purposes.

Stark.—Tree very strong, with a roundish head, and spreading branches. Fruit roundish, oblong, conical; cavity broad, narrow; stalk three-fourths inch long, stout; basin narrow, much plaited; calyx closed, tips pointed, segments erect, reflexed; calyx tube the frustrum of a cone; color greenish-yellow, striped and splashed with light and dark red, with more or less cinnamon russet; flesh pale yellowish white, juicy, firm and crisp, mild, sub-acid; core large, nearly closed; seeds few, obovate; quality good. Season December to May; size large. Generally an early-bearing, productive variety, valuable on account of its keeping qualities.

Stuart, *Golden*.—Tree quite strong, spreading. Fruit round, oblate, corrugated; cavity deep, acute, russet; stalk one-half to one inch in length; basin rather deep and broad, corrugated; calyx nearly or quite closed, segments erect; calyx tube conical; color greenish-yellow with a brownish-red blush in the sun, moderately sprinkled with brownish dots and specks which nearly overspread the whole surface; flesh white, rather juicy, crisp, tender, sprightly, acid; quality good. Season November to January; size medium.

Stump.—Tree with a symmetrical, roundish, conical head. Fruit roundish, conical, inclining to oblong conical, sometimes with sides a little unequal; cavity medium, often russeted; stalk three-eighths inch long, rather small; basin a little above medium, slightly plaited; calyx small, closed or partially open; calyx tube conical; color white, shaded with bright red, and moderately striped and splashed with crimson over most of the surface with a few large and small light dots; skin smooth; flesh white, juicy; fine grain, tender, with a pleasant, sub-acid flavor; core rather large, open. Season September and October; quality good; size medium.

Summer Pearmain, *American*.—Tree fairly strong with an upright habit, young wood, slender, reddish brown. Fruit oblong, slightly conical; cavity deep with a little cinnamon russet; stalk one inch long, medium size; basin rather broad, deep, regular; calyx nearly closed, segments erect with tips recurved; calyx tube long, funnel-shaped; color red, streaked with bright red and yellow in the sun, with many yellowish dots and more or less russet; flesh whitish, juicy, very tender, mild, sub-acid, very rich; quality excellent. Season September; size medium. Both foliage and fruit are somewhat subject to the attack of the apple scab fungus, unless sprayed. When well grown it is one of the best summer varieties for dessert purposes.

Summer Rose.—Tree quite strong with spreading branches, young wood grayish brown, with many light-gray or white dots. Fruit oblong; cavity broad, moderately deep, slightly corrugated; stalk one inch long, rather stout; basin broad, uneven, rather deep; calyx large, slightly open, segments somewhat recurved; calyx tube conical; color red, blushed and striped upon a yellowish white ground; flesh white, tender and juicy, with a brisk sub-acid flavor; core closed, seeds few. Season August; quality good; size medium.

Thornton.—Tree quite vigorous, upright; young wood dark brown. Fruit roundish; cavity deep with dense gray russet; stalk five-eighths of an inch long; basin abrupt, slightly plaited; calyx closed or slightly open; calyx tube obtuse, conical; color greenish-yellow, washed and striped with dark red, netted with rough, dark red russet; flesh white, moderately juicy, firm, crisp, sub-acid. Season November to February; quality fair to good; size medium. An early bearer.

Titovka.—Tree very vigorous with an upright habit, but with branches much spreading. Fruit oblong, slightly conical, irregular; cavity very deep, irregular; basin puite irregular, ribbed, deep; stalk one-half inch long, stout; calyx large, nearly closed; calyx tube funnel-shaped; color greenish- yellow, often nearly covered with dark red, striped with darker red; flesh white, juicy, crisp, sub-acid; core medium, nearly closed; seeds medium, ovate, plump. Season September; quality good; size large. An early and productive bearer, valuable either for home use or market purposes.

Water.—Tree fairly vigorous with upright habit; young wood dark brownish-black. Fruit roundish or ovate to roundish conical; cavity medium with a faint grayish-brown russet; stalk three-fourths of an inch long, rather slender; basin small to medium, abrupt, corrugated; calyx closed; calyx tube conical; color yellowish white, shaded with purplish crimson in the sun, with a few brown dots and specks; flesh white, juicy, tender, sprightly, sub-acid, pleasant; quality good. Season October to November; size medium to large. Thus far only fairly productive.

Washington Strawberry.—Tree quite vigorous, rather spreading; young wood, stout, dark brown; foliage dense. Fruit oblong, conical; cavity narrow, deep; stalk three-fourths to one inch long, medium to large; basin rather narrow and abrupt, corrugated; calyx medium, nearly closed; calyx tube funnel-shaped; color yellow, mostly overspread with stripes of bright red, with a little brownish russet in the cavity; surface covered with light dots. Season September to October; quality good; size large. A generally productive and valuable variety for home and market use.

Wealthy.—Tree vigorous, with a roundish head and spreading, slender branches. Fruit roundish, oblate, slightly conical; cavity broad, acute, russet; stalk three-fourths of an inch long, slender; basin narrow, abrupt, uneven; calyx closed; segments long, tips reflexed; calyx tube long, funnel-shaped; color pale yellow, mostly overspread with dark red, obscurely striped; dots large, light; flesh white, juicy, firm, sub-acid; core closed, seeds few, quality good; season October to December; size large. An early bearer and generally quite productive. One of the most promising of the new fall sorts. Tree very hardy.

Whitney, 20.—Tree quite vigorous, with an upright habit. Fruit ovate, conical; cavity narrow; stalk one inch long, rather stout; basin medium, plaited; calyx closed; calyx tube long, funnel-shaped; color dark red on yellowish ground; surface of fruit covered with specks, spots and flecks of yellow; flesh pale yellow, juicy, crisp, mild, sprightly, sub-acid. Season August and September; quality good; size large for a crab. One of the hardiest and best of the crabs.

Winter Streifling.—Tree quite vigorous with a roundish head and spreading branches. Fruit roundish, slightly oblate; cavity, broad, deep, slightly russet; stalk one inch long, rather slender; color whitish yellow, striped and splashed with dark red; basin medium size, plaited or ribbed; calyx large, closed; tips reflexed; calyx tube large, long, conical; flesh yellowish-white, moderately juicy, rather coarse, tender, brisk, sub-acid; core medium, compact; seed large, plump; quality medium; size large; quite productive. Season October to November. Well worthy of trial in the Northern part of the State, where it would probably be an early winter sort.

Yellow Transparent.—Tree quite vigorous, with an upright form; young shoots, dark olive. Fruit roundish, remotely conical; cavity broad, deep, irregular; stalk seven-eighths of an inch long, stout; basin shallow, corrugated; calyx nearly closed; calyx tube conical; color light yellow, with numerous light brown spots; flesh white, juicy, a little coarse, tender, acid; core medium, open; seeds many; quality fair; size medium to large. Season August. A valuable early variety.

York Imperial.—Tree quite vigorous, with an upright habit, but with spreading branches. Fruit oblate, somewhat oblique; cavity, broad, deep, russeted; stalk three-fourths of an inch long, stout; basin broad, deep, slightly corrugated; calyx small, closed, or partially open; calyx tube funnel-shaped; color light yellow, shaded with crimson in the sun, with numerous large, light gray specks; flesh yellowish white, sprightly, sub-acid. Season November to February; quality good; size large. A valuable sort for home use or market purposes.

Zolotoreff.—Tree fairly vigorous, with spreading habit. Fruit round with a rough surface; cavity narrow, rather deep, corrugated; calyx open; calyx tube broadly conical; color pale yellow, shaded, striped and splashed with light and dark red; flesh white and moderately juicy, inclined to become rather coarse; firm, crisp, mild, sub-acid. Season August to September; quality fair; size large. Fairly productive.

Zuzoff.—Tree quite vigorous, with a roundish head. Fruit rounded, conical; cavity narrow, rather deep, irregular; stalk one inch long, moderately stout; basin narrow, plaited; calyx medium sized, closed, segments stout, reflexed; calyx tube conical or slightly funnel-shaped; color pale yellow, nearly covered with two shades of red, with many yellowish specks, and with a slight whitish bloom; flesh white, moderately juicy, tender, brisk, mild, vinous. Season September to October; size medium to large; quality rather poor. Seems to have little value unless for the cooler parts of the State.

CHERRIES.

Aside from a few varieties, planted from year to year, most of the cherry trees were set in 1890 and 1891 and have developed sufficiently to indicate their probable value. During the season of 1898, however, comparatively few varieties gave a full crop, and hence it is not possible to judge of the relative productiveness of the kinds. The trees were sprayed with a strong solution of copper sulphate previous to the opening of the buds, and, as soon as the fruit had set, were again thoroughly sprayed with Bordeaux mixture and Paris green, the latter being used at the rate of three ounces to forthy gallons. On the fifteenth of June, the black aphis having appeared on a few of the trees, they were sprayed with tobacco water, and the application was repeated upon the twenty-third of June and the third of July, on such trees as required it. Although it had been quite troublesome in previous years, the presence of the cherry slug was not observed at any time during the season.

TABULATION OF CHERRIES, 1898.

Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale 1 to 10.	Quality—scale 1 to 10.	Vigor—scale 1 to 10.
Abbesse	Morello	1888	May 4	7 2	2–17	4 5	4 5	8 9
Angouleme	Duke	1888	" 9	7 3	2–12	2	7 8	10
Badacconyi	Avium	1894	April 30	7 5	2 9	3	5 6	8
Baendor	Morello	1892	May 9	--- ---		---	-	9 10
Baltavari	Avium	1894	" 1	7 2	2–14	1 2	7 8	------
Bessarabian	Morello	1888	" 4	7 7	2–10	3 4	5	10
Brusseler Braune	Morello	1888	" 9	7 18	2–14	3 4	5 6	10
Carnation	Duke	1891	" 4	8 23	2–10	9 10	7 8	8 9
Centennial	Avium	1893	" 2	7 9	2–8	1	6 7	7
Choisy	Duke	1888	" 2	6 22	2–14	1	10	10
Cleveland	Avium	1888	" 2	6 23	2–10	8 9	6 7	10
Coe	Avium	1888	" 2	6 18	2–8	2 3	10	9 10
Downer	Avium	1888	" 2	6 30	2–10	2 3	8 9	9
Dwarf Rocky Mountain	Besseyi	1894	" 16	-- ---	-----			8 9
Dyehouse	Morello	1891	" 6	6 21	2–10	10	5 6	8 9
Eagle (*Black*)	Avium	1888	" 2	6 21	2–10	5 6	10	8 9
Early Purple	Avium	1892	" 1	6 11	2–12	3	7 8	9 10
Elton	Avium	1892	" 2	6 23	2– 0	5 6	8 9	9 10
Esperen	Morello	1892	" 6	6 28	2–10	2 5	5 6	9 10
Eugenie	Duke	1888	" 2	6 17	2–10	6 7	7 8	7 8
Everbearing	Duke	1892	" 7	6 24	2–12	8 9	5 6	8
Florence	Avium	1892	" 6	--- --		- - -		7 8
Frauendorfer Weichsel	Morello	1888	" 4	6 30	2–10	2 3	6 7	9 10
Galopin	Morello	1891	" 8	-- -----		- --		7 8
George Glass	Morello	1888	" 10	7 11	2–10	1	5 6	10
German	Avium	1894	April 29	7 6	2–14	3 4	2 4	9 10
Griotte du Nord	Morello	1888	May 9	7 13	2–15	1 2	6 7	10
Hortense	Duke	1888	" 6	7 2	2–10	1	7 8	7 8
Ida	Avium	1893	" 3	--- - ---	2–8	8 9	8 9	9 10
King Amarelle	Morello	1891	" 9	6 24	2–30	7 8	6 7	9 10
Knight Early	Avium	1891	" 4	6 24	2–20	3 4	9	9 10
La Maurie	Avium	1893	" 2	--- - ---	-----	--		9 10
Lancaster	Morello	1894	" 6	6 25	2–16	1	5 6	10
Late Duke	Duke	1890	" 8	7 2	2–10	1	6 7	9 10
Lithauer Weichsel	Morello	1892	" 9	7 7	2–20	8 9	4 5	9 10
Lutovka	Morello	1888	" 9	7 29	2–10	2 3	5 6	9 10
Magnifique	Duke	1888	" 12	7 13	2–12	9 10	8 9	8
Mahaleb	Mahaleb	1893	" 13	--- ---	-			8 9
Mary Kirtland	Avium	1891	" 2	6 21	2–10	9 10	6 7	6 8
Mastodon (*Black*)	Avium	1893	" 1	---------	----	-----		8
May Duke	Duke	1888	" 6	6 20	2–10	8 9	7 8	8 9
Mezel	Avium	1891	" 1	6 24	2–12	4 5	8 9	8 9
Minnesota (*Ostheim*)	Morello	1892	" 8	6 30	2–14	5	6 7	9 10
Modnyansky	Avium	1894	" 2	7 5	2–10	1 2	5	9 10
Montmorency	Morello	1888	" 9	6 21	2–12	5 6	5 6	8
Montmorency Ordinaire	Morello	1891	" 9	7 2	2–10	10	5 6	10
Montrueil	Duke	1890	" 8	7 1	2–12	9 10	8 9	9 10
Napoleon	Avium	1892	" 2	7 5	2–6	8 9	5 6	8 9
Northwest	Morello	1893	" 13	7 5	2–22	10	4 5	8
Ohio (*Beauty*)	Avium	1891	" 3	6 21	2–12	8 9	6 7	8 9
Olivet	Duke	1891	" 7	6 25	2–10	2 3	6 7	10
Orel 25	Morello	1893	" 9	7 13	2–13	2 3	4 5	9 10
Orel 27	Morello	1893	" 11	7 28	2–14	1 2	4 5	10
Ostheim	Morello	1891	" 7	6 29	2–14	3 4	5 6	9
Ostheimer	Morello	1893	" 13	6 29	2–10	7 8	4 5	10
Philippe (*Louis*)	Morello	1888	" 3	6 22	2–10	2 3	7 8	9 10
Plymouth Rock	Avium	1896	" 13	7 28	2–10	1	7 8	8
Purity	Avium	1893	" 7	-- ------	-----	-		
Richmond	Morello	1893	" 8	6 21	2–12	8 9	4 5	9 10
Rockport	Avium	1891	" 3	6 20	2–10	6 7	8 9	10

Tabulation of Cherries—CONCLUDED.

Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale 1 to 10.	Quality—scale 1 to 10.	Vigor—scale 1 to 10.
Royal Duke	Duke	1891	May 8	6 17	2-15	4 5	7 8	6 7
Rocky Mt. Dwarf	Besseyi	1894	" 16	------	------	------	------	8 9
Rupp	Duke	1884	" 9	------	------	------	------	9 10
Schmidt	Avium	1894	" 6	------	------	------	------	9 10
Sebrel	Avium	1896	" 14	------	------	------	------	8
Sklanka	Morello	1888	" 9	6 21	2-16	3 4	5 6	7
Spanish (*Yellow*)	Avium	1891	" 2	6 30	2-10	9 10	10	8 9
Spate Amarelle	Morello	1888	" 11	7 2	2-10	5 6	6 7	8
Strauss Weichsel	Morello	1888	" 6	6 22	2-12	1	5 6	10
Suda	Morello	1893	" 13	7 7	2-15	10	4 5	9
Tartarian (*Black*)	Avium	1888	" 2	6 18	2-10	4 5	10	10
Ulatis (*Cal. Adv.*)	Avium	1893	April 30	------	------	------	------	10
Weir 2	Morello	1893	May 9	6 22	2-10	10	6 7	9 10
White (*Bigarreau*)	Avium	1896	------	------	------	------	------	8 9
Windsor	Avium	1891	" 2	6 29	2-10	9 10	6 7	8 9
Wood (*Gov.*)	Avium	1891	" 2	6 21	2-12	10	5 6	9
Wragg	Morello	1892	" 11	7 4	2-14	8 9	4 5	8 9

Although not very productive, several of the varieties of cherries, including a number imported by Prof. Budd, from Russia, were in fruit the past season. The following have been most thoroughly tested:

Morello. Abbesse.—Tree spreading in growth, with slender and somewhat drooping branches; fruit quite small, of an irregular, globular form; stalk one and one-half inches long, quite slender and set in a very shallow cavity; color very dark purple, nearly black, with many minute, light specks; flavor quite acid and very astringent; flesh very dark with red juice; moderately tender; a tardy bearer and slow growning tree; not likely to be of value; ripe July 2.

Bessarabian.—Tree of an upright habit with spreading branches; quite strong and vigorous; ripe July 7; fruit of medium size, roundish, slightly compressed; stalk one and one-half to two inches in length, moderately stout, set in a medium sized cavity; color dark crimson; flavor vinous, acid; flesh tender and with red juice. It has thus far shown itself to be only moderately productive.

Brusseler Braune.—A Morello variety with a very strong, upright growth, but with branches somewhat drooping; ripe July 18; fruit very large, roundish, inclining to heart shape; stalk quite long, two to two and one-half inches, stout; in a small open cavity; color very dark crimson, becoming a rich, brownish black; flavor rich and acid; flesh tender, juicy, red; juice dark. The most promising of the Russian varieties that have thus far fruited. It ripens at about the same time as the English Morello, which it exceeds in size, and as the trees are stronger growers, it may in time take the place of that well-known sort.

Dyehouse.—Tree of moderate growth, rather slender and of a spreading habit. Ripe June 26; fruit of medium size, roundish, slightly oblate; stalk one inch long, set in a rather broad cavity; color pale red; flesh tender; juice acid, high-colored. One of the earliest of the sour cherries, which has this year been among the most productive.

Esperen.—Tree quite vigorous, roundish with spreading branches. Fruit large, roundish oblate, compressed; stalk one inch long, stout, set in a broad, deep cavity; color dark scarlet; flesh tender, juicy, quite acid. Season the last of June. A promising variety for market and cooking purposes, if it proves productive.

Fraudendorfer Weischsel.—Tree very vigorous, of a spreading or partially upright habit, with drooping branches. Ripe July 12; fruit large, heart-shaped, roundish, slightly compressed; stalk two inches long, moderately strong; cavity medium; color very dark, bright crimson; flesh tender with a vinous flavor; juice crimson; quality good; a valuable variety for home use or market and one of the best for cooking purposes.

George Glass.—Tree very vigorous with a spreading top. Ripe July 12; fruit large, ovate; stalk one and three-fourths inch long, stout, set in a rather deep cavity; color dark crimson; flesh tender, light colored, with a vinous flavor; juice colorless. Has thus far proved unproductive.

Griotte du Nord.—Tree quite vigorous, upright, spreading. Fruit of medium size, roundish, inclined to heart shape; stalk one and one-half to one and three-fourths inches long, very stout, set in a shallow, small cavity; color dark crimson, nearly black at maturity; flesh tender; flesh and juice dark; highly acid, rich; quality good; ripe July 15. Thus far unproductive.

King Amarelle.—Tree quite vigorous, very spreading. Fruit medium size; ripe June 25; roundish, slightly oblate; stalk one and one-half inches long, rather slender, set in a broad, shallow cavity; color dark scarlet; flesh moderately tender, juicy, mild, acid; quality good. A productive and probably valuable sour cherry for market purposes.

Lancaster.—Tree very vigorous, spreading. Fruit medium size, ripe June 25, roundish; stalk one and one-half inches long, moderately stout, set in a wide cavity; color bright, dark scarlet; flesh tender, very juicy; juice colorless; flavor vinous, sprightly; quality good. Rather small and as yet, quite unproductive.

Lithauer Weichsel.—Tree quite vigorous, with a spreading head, and slender, drooping branches; ripe July 8; fruit rather small, globular; stalk two inches long, very strong; color very dark crimson, nearly black at maturity; flavor very acid, astringent; flesh tender, flesh and juice very dark crimson; quality poor. A hardy, productive variety, but not likely to be valuable.

Lutovka.—Tree very vigorous, spreading. Fruit medium to large, ripe July 8, roundish oblate, with suture one-half around; stalk about one and five-eighths inches long, variable, stout, set in a rather wide cavity; color dark scarlet; flesh tender, moderately juicy, vinous; flesh and juice light-colored; quality good. A hardy variety and one likely to prove valuable for market if the trees prove productive.

Minnesota.—Tree quite vigorous, with a round, spreading head. Fruit ripe June 30, medium size, roundish, heart-shaped, slightly compressed; stalk one and one-half to one and three-fourths inches long, set in a medium cavity; stem strong; color very dark crimson, almost black; flesh tender, sub-acid, rich; flesh and juice very dark crimson; quality good. A promising variety in sections where hardiness is necessary.

Montmorency.—Tree moderately strong, with a round, spreading head. Fruit ripe June 21, large, roundish oblate; cavity broad and deep; stalk one inch long, stout; color reddish amber; flesh tender, acid; justice pale; quality good. One of the most valuable of the Morello cherries for home use or market.

Montmorency Ordinaire.—Tree quite vigorous, roundish, upright. Fruit ripe July 2, large, roundish; stalk one to one-half inches long, stout, set in a medium cavity; color crimson; flesh tender, vinous, sprightly, pleasant. Quite productive. The trees received under this name seem rather more productive and fully as desirable as those grown as Montmorency.

North West.—Tree vigorous, spreading. Fruit small, ripe July 5, globular; stalk one and one-fourth to one and one-half inches long, quite slender, set in a small cavity; color red; flesh tender, brisk, acid, astringent; flesh and juice crimson; quality rather poor. Although quite productive, it does not seem to be of value.

Orel 25.—Tree vigorous, upright, spreading. Fruit ripe July 13; medium to large, oblate, compressed; stalk one and one-fourth to one and one half inches long, quite strong; cavity rather deep; flesh tender, acid, slightly bitter; flesh and juice light-colored; quality rather poor. Lacking in productiveness and apparently of no value.

Orel 27.—Tree strong growing, upright, slightly spreading. Ripe July 28; fruit medium size, roundish, heart-shaped; stalk one and one-half to two inches long, very stout; color dark crimson at maturity; flesh tender, vinous, astringent; flesh and juice reddish; quality rather poor; not likely to prove valuable.

Ostheim.—Tree quite vigorous with a spherical head; branches upright, with drooping twigs. Fruit small, roundish; stalk one and one-half inches long, medium size, in a shallow cavity; color dark red at maturity; flesh tender, very dark crimson; juice dark red; flavor rich, sub-acid. Season June 30. A very productive variety that is promising as a cherry for cooking purposes, in sections where hardiness is required.

Ostheimer.—Tree quite vigorous, spreading. Fruit medium size, roundish, heart-shaped; stalk one and one-fourth to one and three-fourths inches long, slender, set in a medium cavity; color dark red, almost black at maturity; flesh tender, juicy, crimson; juice dark red; flavor acid, astringent; of rather poor quality, but a hardy and productive variety.

Philippe (Louis).—Tree very vigorous, somewhat spreading. Fruit roundish, oblate; stalk one and one-fourth inches long, stout, set in a moderately deep cavity; color dark red, nearly black when fully ripe; flesh rather firm, moderately juicy and very acid; quality good. Season June 23. The tree seems to lack productiveness, but otherwise it appears to be a valuable sort.

Richmond.—Tree quite vigorous, with slender, spreading branches. Fruit medium to large, roundish, heart-shaped; stalk one and three-eighths inches long, set in a moderately deep cavity; color very dark scarlet; flesh rather soft, juicy, acid. A valuable variety for cooking and market purposes. Season June 22.

Sklanka.—Tree rather slow growing, but fairly stout and healthy, habit rather spreading. Fruit medium size, roundish, stalk slender, one and three-fourths inches long; color dark scarlet; flesh moderately firm, vinous and very juicy; quality good. Season June 21. This is a hardy variety, but it has thus far not shown itself very productive.

Spate Amarelle.—Tree rather vigorous, upright with spreading branches. Fruit medium to large, roundish, heart-shaped; stalk one and one-half inches long, stout, in a shallow cavity; color light read, with a dark blush; flesh tender, juicy, light colored; juice colorless, highly vinous; quality good. A hardy and fairly productive variety, worthy of trial for market plantations.

Suda.—Tree quite vigorous, upright, spreading. Fruit medium size, globular; stalk one and one-fourth to one and one-half inches long, rather slender, set in a small cavity; color very dark purple; flesh tender; juice crimson; flavor acid, slightly astringent; quality rather poor. A very hardy and productive variety, ripening the 7th of July.

Strauss Weichsel.—Tree quite vigorous, upright, spreading. Fruit medium size; roundish oblate; stalk one and one-half inches long, rather slender, set in a shallow cavity; color dark crimson; flesh tender, acid, juicy; quality good; pit rather small. Season June 22. It has thus far shown itself rather lacking in productiveness, but otherwise it is a promising variety.

Wier No. 2.—Tree rather small, spreading. Fruit medium size, roundish, oblate; stalk one and one-fourth inches long, rather stout, set in a broad cavity; color pale red, or reddish amber; flesh very tender and juicy, acid; quality good. Season June 22. A hardy and productive variety, and although rather slow in its growth, it seems to be a promising sort.

Wragg.—Tree rather vigorous, spreading. Fruit large, roundish, heart-shaped; stalk one and one-half inches long, medium size; cavity shallow and small; color very dark crimson, nearly black at maturity; flavor acid, slightly astringent; flesh and juice light crimson, firm; quality good. Season July 4 to August 4. A productive and promising variety, somewhat like the English Morello, but with a stronger growing tree.

Dukes.—Angouleme is a Duke variety, with a round, spreading head; fruit of medium size, and oblate in form; stalk one and one-half inches long, moderately strong and set in a cavity of medium size; color scarlet, with many minute light spots; flavor pleasant and sub acid; flesh tender and colorless, with a light juice; quality very good. Ripe July 3 to 17. Thus far this variety has been lacking in productiveness.

Carnation.—A strong-growing Duke variety, with a round, spreading head; ripe June 23; fruit large, roundish, slightly compressed and somewhat heart-shaped; stalk slender, one and five-eighths inches in length, in a broad, deep cavity; color light crimson; flavor pleasant, mild and vinous; texture quite firm. Until this season the variety has been lacking in productiveness, but as the trees become older, the crop has each year increased, until in 1898 it was among the most productive kinds.

Eugenie.—Tree moderately strong, roundish, upright. Fruit large, oblate, heart-shaped, compressed; stalk one and one-half inches long, rather stout; color light scarlet or amber; flesh mild, acid, very juicy, soft and tender; quality quite good; ripe June 20. A valuable variety for dessert or cooking purposes.

Everbearing.—Trees moderately vigorous, upright in habit, with spreading branches; ripe June 25. Fruit large, roundish oblate, slightly compressed; stalk one and one-half inches long, very stout, set in a broad, shallow cavity; color dull red, rather pale, becoming very dark when fully ripe; flesh rather tender, moderately juicy, mild, acid; quality good. An early bearing and productive variety that remains a long time in season, and is a valuable variety, especially for home use.

Montrueil.—Tree quite vigorous, upright. Fruit ripe June 26; large, roundish, heart-shaped; stalk one and one-half inches long, moderately stout, set in a medium cavity; color amber, with a lively red cheek, slightly mottled; flesh tender, pleasant, sub-acid; flesh light colored; juice colorless; quality very good. A productive variety that is of value for home use or market.

Olivet.—Tree quite vigorous, upright, spreading. Ripe June 25; fruit large, globular, heart-shaped; stalk one and three-eighths inches long, rather stout, set in a broad, deep cavity; color deep red or crimson, very glossy; flesh tender, rich, vinous, with a mild, sub-acid flavor; flesh red, with rose colored juice; quality good. Is yet somewhat lacking in productiveness.

Royal Duke.—Tree quite vigorous, upright in habit. Fruit large, heart-shaped, compressed; stalk one and one-half inches long, moderately stout, set in a rather broad cavity; color dark crimson; texture moderately firm; sprightly, vinous; quality good. A fairly productive and valuable sort, either for home or market.

Hearts and Bigarreaus. Centennial.—A variety from Oregon; tree very upright, slightly spreading and fairly vigorous in growth; ripe July 9; fruit very large, heart-shaped, compressed; stalk one to one and one-half inches long, set in a very large, broad cavity; color clear, bright yellow, delicately marbled with light crimson, deepened to dark crimson in exposed specimens, and well marked with light dots and specks; flavor very sweet and pleasant; flesh tender, breaking, light colored wita a colorless juice. If it proves sufficiently productive, it bids fair to be a valuable sort.

Cleveland.—Tree quite vigorous, with a round, spreading head; ripe July 1; fruit large to very large; roundish, oblate, compressed, remotely heart-shaped; stalk one and one-half inches long, of medium size, set in a moderate cavity; color whitish yellow, with bright red blush; flavor sweet and vinous, pleasant; flesh juicy but rather firm. One of the best of the Bigarreau varieties and a valuable sort for planting in sections where sweet cherries can be grown successfully.

Coe *Transparent.*—Tree vigorous, with a roundish, spreading top; ripe June 26; fruit very large; roundish, oblate, heart-shaped with a deep cavity; stalk one and three-fourths inches, of medium size; color pale yellow, with a bright blush on one side; flavor delicate, sweet and rich; flesh very tender, light-colored; quality very good. Although it may not be of great value as a market sort; yet the handsome appearance and high flavor would make it one of the most desirable sorts for home plantations. It seems to be preferred by the birds to any of the other varieties.

Badacconyi.—A strong growing Bigarreau variety from Hungary. Tree very spreading with large, drooping leaves; fruit very large, heart-shaped, compressed; stalk one and one-half inches long, rather slender, set in a deep, wide cavity; color red, nearly covered with dark purple, but marked with pale spots; flavor sweet, sub-acid; flesh crisp and breaking, pinkish with dark-colored juice; quality quite good. The trees are too young to judge of their productiveness, but if sufficiently productive it promises to be a very valuable variety.

Baltavari.—Introduced at the same time as Badacconyi. Tree upright with somewhat spreading branches and large drooping leaves; season July 2 to 18; fruit large, heart-shaped; stalk one and one-fourth to one and one-half inches long, moderately stout, set in a cavity of medium depth; color light amber, nearly covered with bright carmine, in the sun and with many minute light spots; flavor rich and sprightly, pleasant; flesh melting, tender and juicy, pale amber with a colorless juice; not fully established.

Downer.—Tree quite vigorous, of an upright habit, with spreading branches; ripe July 1, fruit quite large, roundish, heart-shaped; stalk one and one-half inches long set in a slight depression; color a lively red, mottled with amber in the shade; flavor sweet, pleasant; flesh tender, melting. Although the trees have not as yet shown themselves to be productive, the variety has been quite thoroughly tested in other sections, and shown itself to be a valuable variety for either the home or market plantations.

Eagle Black.—Trees quite vigorous, upright, spreading; ripe June 21; fruit quite large, heart-shaped, compressed; stalks one and one-half to one and three-fourths inches long, set in deep cavity; color deep purple, nearly black; flavor very rich; flesh tender, juicy, deep purple with a very dark colored juice; quality very good. A variety well known for its hardiness and productiveness.

Early Purple.—Trees moderately vigorous, upright and spreading; season June 18; fruit large, roundish, heart-shaped, compressed; stalk two inches long, rather slender; color darp purples, nearly black when fully ripe; flavor sweet, vinous; flesh tender, juicy; quality very good.

Elton.—Trees moderately vigorous, upright, spreading; ripe June 23; fruit quite large, roundish, compressed, heart-shaped; stalk one and three-fourths inches long, rather slender, set in a narrow cavity; color pale yellow, blushed with red; flavor sweet, vinous, excellent; flesh rather firm but juicy; quality very good. One of the best of the Bigarreau varieties.

German.—Tree quite vigorous. Fruit ripe July 7; large, roundish, heart-shaped; stalk one and three-fourths inches long, quite slender, in a broad, moderately deep cavity; color very dark red, nearly black at maturity; flesh very firm, red, sweet, with a slight bitter taste; juice very dark. As yet it has not shown itself productive, or to have any valuable characteristics.

Ida.—Trees strong growing, upright. Fruit ripe June 28, roundish heart-shaped, slightly compressed; stalk one and one-half inches long, medium size, set in a broad, shallow cavity; color carmine, with a faint blush; flesh rather firm, vinous, sweet, juicy, rich; quality very good. A valuable dessert or market variety if it proves productive. The crop in 1898 was much injured by birds.

Napoleon.—Tree quite strong, upright, spreading. Fruit ripe July 5, quite large, heart-shaped, compressed; stalk one and three-fourths inches long, rather stout, set in a narrow cavity; color pale, yellowish amber in the shade, with a very deep red and dark marbled crimson cheek, in the sun, richly dotted and specked; flesh very firm, juicy, sweet, excellent; quality good. One of the best of the Bigarreau cherries and a profitable variety when the fruit is not destroyed by the brown rot.

Ohio Beauty.—Tree rather vigorous, spreading. Fruit ripe June 21, large, roundish, heart-shaped; stalk one and one-half inches long, quite slender, cavity medium; color yellowish white, mostly covered with light and dark red; flesh tender juicy, sweet, excellent; flesh and juice colorless; quality very good. A fairly productive and valuable sweet variety.

Plymouth Rock.—Moderately vigorous, quite upright. Fruit large, heart-shaped; stalk one inch long, moderately slender, set in a small, shallow cavity; color reddish amber, with a bright red blush; flesh rather tender, juicy, light colored; juice colorless; pit round, plump; flavor sweet pleasant. Season quite late. Trees are too young to determine their fruitfulness, but it seems to be a promising variety for home use and may prove a valuable sort for market.

Rockport.—Tree quite vogorous, upright in habit, but becoming spreading as the trees get older. Fruit large to very large, roundish, compressed, heart-shaped; stalk one and one-half inches long, rather stout, in a moderate cavity; color pale, whitish yellow, with dark red blush; texture tender, very juicy, with a sweet, vinous and rich flavor; quality very good. Quite productive and one of the best of the sweet cherries. Season June 20.

Tartarian *Black.*—Tree of vigorous growth, upright with large, glossy leaves. Fruit large, heart-shaped; stalk one and one-half inches long, rather slender, set in a broad, deep cavity; color bright purplish, blush glossy; flesh rather tender, juicy, very rich, delicious; flesh and juice purplish; quality very good. Season June 18. One of the best of the sweet cherries and fairly productive in sections where heart cherries succeed.

Spanish (Yellow).—Tree vigorous growing, with a large and handsome head, and spreading branches. Fruit large, heart-shaped, compressed; stalk one and one-half inches long, stout, set in a broad, moderately deep cavity; color pale, whitish yellow, bordered with minute crimson dots, and deepening into bright red, and finely marbled on the sunny side; texture rather firm, juicy; flavor rich, sweet, delicious; quality very good. Season June 30. One of the most productive of the sweet cherries.

Windsor.—Tree vigorous with upright branches, and somewhat spreading twigs. Fruit large, heart-shaped, compressed; stalk one and one-fourth to one and one-half inches long, rather slender; color bright crimson, with many light specks; flesh very firm, breaking, sweet, pleasant, vinous. Season June 29. Quite productive and a promising sort.

Wood *Gov.*—Tree vigorous, upright, with spreading branches. Fruit large, heart-shaped; stalk one and three-fourths to two inches long, slender, in a medium cavity; color light scarlet; flesh very tender, mild; quality good. One of the most productive and valuable of the sweet cherries.

PEACHES.

The trees were pruned early in April and the new growth was cut back about one-half, and a considerable amount of thinning was also done. The spraying was attended to as explained in another section and where preformed before the first of April, it sufficed to prevent the attack of leaf curl, but even where the trees were free from this disease, many of the varieties failed to set a full crop. A large number of varieties, however, showed so large a crop that it was necessary to remove a considerable number of the fruits. The thinning was completed on the 15th of June.

The trees upon which the notes have been taken are, for the most part, from five to eight years old, but a few varieties were planted as early as 1888. They have been grown without crops for a number of years and have been given quite thorough cultivation, and at least every other year have received an application of either decomposed manure or wood ashes. Each spring the trees have been cut back and thinned out, and as a result of this treatment, they have been kept in a compact form and the new growth is quite strong and vigorous. As a result of this treatment there is less difference in the form and size of the trees than is usually the case, and as will be observed, the notes regarding their form and size show but slight variations between the different sorts. Where trees are not cut back, a much larger proportion will develop a drooping habit than where they are pruned each year and this will account for the small number of trees to which the drooping habit is ascribed.

TABULATION OF PEACHES—(Prunus.)—1898.

ABBREVIATIONS: Size—scale 1 to 10—1, very small; 10, very large. Form—c, compressed; o, oblate; ov, oval; r, round. Color—c, creamy; g, green; r, red, w, white; y, yellow. Adhesion—c, cling; f, free; s, semi-cling. Quality—1 to 10—1, very poor; 10, best. Flowers—l, large; s, small. Glands—g, globose; r, reniform; s, surrate.

Number.	Names.	Planted.	Bloomed.		Glands.	Ripened.	Adhesion.	Weight of specimen in ounces.	Productiveness—Scale 1 to 10.	Form.	Color.		Quality—Scale 1 to 10.
			Date.	Size.							Skin.	Flesh.	
1	Adrian	1892	May 9	s	g	Sept. 28	f	4½	1	r ov	y r	y r	6 7
2	Alberge	1893	" 8	s	r	Aug. 3	f	3	4	r	y r	y r	3 4
3	Albright	1890	" 7	s	g	Sept. 21	f	5½	1	r	c w	c w r	5 6
4	Allen	1890	" 9	s	r	Oct. 5	f	6	2 3	r ov	y r	y r	5 6
5	Alpha	1890	" 9	s	r	Sept. 2	c	6	1	r	y r	y r	5
6	Amelia	1890	" 9	s	r	Sept. 2	f	5¼	2	r	c w r	w	6 7
7	Amsden	1890	" 7	l	g	July 23	c	5	5	r c	r	w	5 6
8	Barber	1893	" 9	s	r	Sept. 17	f	5⅓	1	r ov	y r	y r	6 7
9	Beers Smock	1890	" 9	s	r	Sept. 5	f	4½	1	ov	y r	y r	5
10	Bell (Fav.)	1890	" 7	s	g	Sept. 21	f	4	1	ov	y r	y r	4 5
11	Bequett (free)	1890	" 7	s	r	Sept. 16	f	6	7	ov	c w r	w r	5
12	Berenice	1894	" 9	l	r	Sept. 19	f	4½	4	ov	y	y	4
13	Bickle	1890	" 7	s	r	Sept. 20	f	4	5	ov	c w r	w r	4
14	Bishop	1890	" 6	l	g	Aug. 18	f	5	5	r	c w r	w	8
15	Blood Leaf	1892	" 7	l	r	Sept. 24	c	3	5	r	w r	w	1
16	Bonanza	1890	" 8	s	r	Oct. 10	f	3½	3	r c	c w r	c w r	1 3
17	Boyle	1890	" 7	s	g	Sept. 19	f	4	4 5	r ov	y r	y r	7
18	Brandywine	1890	" 9	s	g	Sept. 22	f	6	1	r ov c	y r	y r	5
19	Brigdon	1890	" 7	s	g	Sept. 18	f	5	3	r ov	y r	y r	7 8
20	Briggs	1890	" 7	s	g	Aug. 31	f	5⅓	2	r ov	y r	y r	8
21	Bronson	1894	" 7	s	r	Sept. 21	f	5	1	r ov c	y r	y r	6 7
22	Brown	1894	" 2	l	r	Aug. 23	f	3½	8 9	r c	c w r	c w r	5 6
23	Burke	1892	" 7	l	r	Sept. 6	s	7	1	r	c w r	w r	5
24	California	1895	" 7	s	r	Oct. 10	f	6	1	r	y r	y r	6 7
25	Canada	1892	" 6	l	g	July 28	s	4½	8 9	r	g y r	c w	4 5
26	Chairs	1890	" 9	s	r	Oct. 4	f	6½	3	ov r	y r	y r	3 4
27	Champion (Ohio)	1890	" 9	l	s	July 30	c	3	5	r c	c w r	c w	5 6
28	Champion (Mich.)	1894	" 9	s	g	Sept. 2	f	7	1	r	c w r	c w r	10
29	Chili 2	1888	" 9	s	r	Sept. 21	f	5	5 6	r ov c	y r	y r	6 7
30	Chili 3	1888	" 9	s	r	Sept. 21	f	4½	4	r c	y r	y r	8
31	Chinese (cling)	1890	" 9	l	r	Sept. 21	c	6	1	r	c w	c w r	6 7

32	Cleffey (Allen)	1892	" 9	s	r	Sept. 15	f	5½	1	r	y r	y r	5
33	Clifton Cling	1894	" 9	s	r	Sept. 21	c	6	1	r	c w	c w r	6 7
34	Columbia	1890	" 9	l	r	Oct. 1	f	4	8	r	y r	y r	1 2
35	Conkling	1890	" 7	s	r	Sept. 26	f	6	2	r ov	y r	y r	5
36	Connecticut	1886	" 9	s	g	Sept. 6	f	2⅓	1	r c	y r	y r	6 7
37	Connett	1894	" 6	l	r	Aug. 19	s	5	3 4	r ov c	c w r	c w	7
38	Coolidge (Mam.)	1892	" 9	s	g	Sept. 19	f	5	1	r ov	y r	y r	7
39	Corner	1890	" 9	s	r	Sept. 19	f	4½	4	ov	y r	y r	5 6
40	Crosby	1892	" 9	s	r	Sept. 26	f	7	3	r	y	y	7
41	Crothers	1890	" 7	s	g	Sept. 27	f	5½	7	r ov	c w r	c w r	6 7
42	Dennis	1890	" 7	l	g	Sept. 6	f	4	4 5	r	y	y	5 6
43	Diamond	1892	" 9	s	g	Sept. 27	s	5	1	r ov	y r	y r	5
44	Druid Hill	1890	" 7	s	g	Oct. 1	f	5	4	r ov	c w r	w r	8 9
45	Dumont	1894	" 9	s	r	Sept. 7	f	4⅔	2	r ov c	y r	y r	3 4
46	Dunlap	1892	" 9	s	g	Aug 31	f	4	2	r ov	y r	y r	7 8
47	Early Barnard	1888	" 7	s	r	Aug. 31	f	4⅓	5	r	y r	y r	5
48	Early Crawford	1888	" 5	s	g	Aug. 18	f	5½	1	r ov	y r	y r	9 10
49	Early Crawford 1	1888	" 10	s	g	Aug. 31	f	4½	3 4	r ov	y r	y r	7 8
50	Early Crawford 3	1888	" 10	s	g	Sept. 7	f	5	2	r ov	y r	y r	7
51	Early Michigan 15	1894	" 9	l	g	Aug. 29	f	4½	6	r	c w r	c w r	9 10
52	Early Michigan 16	1894	" 9	l	r	Aug. 29	f	5	5	r	c w r	w r	9 10
53	Ede	1890	" 7	s	g	Sept. 19	f	4	2	r ov	y r	y r	6
54	Elberta	1890	" 7	s	r	Sept. 19	f	5	4	r ov c	y r	y r	5 8
55	Eldred (cling)	1890	" 7	s	g	Sept. 17	c	4⅔	4 5	r ov	c w r	c w	4
56	Ellison	1889	" 10	s	r	Sept. 30	f	3	2	r ov	y r	y r	5 6
57	Engle (Mam.)	1892	" 6	s	g	Sept. 3	f	5½	9	r ov	y r	y r	9 10
58	Ford New	1894	" 9	s	g	Sept. 7	f	5	2 3	r	y r	y r	6 7
59	Ford Red	1894	" 5	s	g	Sept. 5	f	4½	3	ov	c w r	c w r	5 6
60	Ford 1	1894	" 7	l	r	Aug. 20	s	4½	8 9	r	c w r	w	7 7
61	Ford 2	1894	" 9	s	g	Sept. 27	f	5	2	r c	y r	y r	6 7
62	Ford 3	1894	" 12	s	r	Failed to ripen	f	5	1	r c	g	w r	4 5?
63	Foster	1894	" 7	s	g	Aug. 31	f	6	2	r c	y r	y r	7 8
64	Fox	1890	" 7	s	g	Oct. 12	f	3½	4	r ov	c w r	c w r	4 5
65	Geary (Hold On)	1890	" 7	s	r	Oct. 8	f	6	4	r ov	y r	y r	5
66	Gem (cling)	1890	" 6	s l ?	r	Oct. 12	c	6	5	r	c w r	c w r	5
67	Globe	1888	" 9	s	g	Sept. 21	f	7	1	r ov	y r	y	5
68	Gold Drop	1890	" 7	l	r	Sept. 27	f	5	5	r ov	y	y	7 8
69	Grant (Gen.)	1890	" 6	s	r	Oct. 5	c	6	2	r ov c	c w r	c w r	6 7
70	Great Western	1892	" 3	s	r	Oct. 12	c	4½	3	r ov	c w	c w	4
71	Gudgeon	1890	" 9	s	r	Oct. 10	f	7½	4 5	r	c w r	w r	5 6
72	Haas	1890	" 7	l	r	Aug. 18	f	4	10	r	w r	c w	5 6
73	Hale	1888	" 8	l	g	Aug. 16	s	3	8 9	r	c w r	c w	5
74	Hale x Oblong	1888	" 9	l	g	Aug. 12	s	4	9 10	r	c w r	c w	6 7
75	Hance Golden	1890	" 7	s	g	Sept. 15	f	3½	2	r	y r	y r	8 9
76	Hance Smock	1890	" 9	s	r	Oct. 1	f	4½	3	r ov	y r	y r	5
77	Husted 101	1895	" 9	s	r	Sept. 21	f	4	1	ov c	y r	y r	3 4
78	Hyatt	1888	" 8	l	g	Aug. 15	s	3	10	r ov	c w r	c w	5 6

TABULATION OF PEACHES—(Prunus)—1898.—Continued.

Number.	Names.	Planted.	Bloomed.		Glands.	Ripened.	Adhesion.	Weight of specimen in ounces.	Productiveness—Scale 1 to 10.	Form.	Color.		Quality—Scale 1 to 10.
			Date.	Size.							Skin.	Flesh.	
79	Hynes	1890	May 9	l	g	Aug. 16	s	3¾	10	r	c w r	c w	5
80	Hyslop	1892	" 8	s	r	Sept. 27	c	6½	1	r	c w r	c w	4
81	Infant Wonder	1892	" 7	s	g	Sept. 2	f	4½	10	r ov	c w r	c w r	5 6
82	Iron Mountain	1895	" 9	s	r	Oct. 14	f	6½	3	ov c	c w	g w	2 3
83	Jacques Late	1890	" 8	s	g	Sept. 21	f	4	2	r ov	c w r	c w r	5 6
84	Japan Dwarf	1894	" 2	l	r	Aug. 6	f	3⅓	2	ov c	c r	w r	3 4
85	Jersey Yellow	1895	" 9	s	r	Oct. 15	f	3	1	r ov	y r	y r	4
86	Jones	1892	" 8	s	g	Sept. 19	s	6	1	r ov	y r	y r	4 5
87	June Rose	1894	" 7	l	g	Sept. 2	f	5⅓	6 7	r ov	w r	w r	6 7
88	Kalamazoo	1890	" 7	s	r	Sept. 16	f	3	9	r c	y r	r r	7 8
89	Kallola	1892	" 7	l	r	Sept. 19	f	4	7	r ov	c w	w r	3 4
90	La Fleur	1895	" 9	l	r	Oct. 3	f	4	1	ov	y r	y	2 3
91	Late Barnard	1892	" 9	s	r	Sept. 16	f	5	5	r ov	y r	y r	6 7
92	Late White	1889	" 9	s	r	Oct. 3	f	6	4	r ov	c w r	c w r	5
93	Lemon Free	1894	" 7	l	r	Oct. 4	f	5	5	r ov	y	y	4
94	Lewis	1890	" 7	l	r	Aug. 19	f	4	6	r c	c w r	c w	6 7
95	Longhurst	1894	" 9	l	g	Sept. 21	f	4½	8	ov	y r	y r	5 6
96	Lorentz	1895	" 8	s	r	Oct. 4	f	4½	1	r	y r	y r	5 6
97	Lovell	1892	" 3	s	g	Sept. 27	f	4⅓	5	r c	y r	y	7 8
98	Lovett White	1890	" 9	s	r	Oct. 8	f	5½	4 5	r	w	c w	6 7
99	Magdala	1890	" 6	s	r	Aug. 31	f	4⅓	5	r	c w r	c w r	8 9
100	Marshall	1890	" 9	s	r	Sept. 28	f	4	4 5	r	y r	y r	5 6
101	McCollister	1890	" 4	s	r	Oct. 1	f	6	5 6	r ov	y r	y r	6
102	McKevitt	1892	" 9	s	g	Oct. 4	c	5½	1	r ov	c w r	c w r	3 4
103	Milhizer	1892	" 9	s	g	Oct. 18	f	6½	1	r	w r	w	5
104	Minnie (Texas)	1890	" 9	s	r	Sept. 7	f	5¼	1	r	c w r	c w r	5 6
105	Moore	1890	" 7	s	g	Sept. 19	f	4	1	r ov	c w r	c w r	7 8
106	Morris Co.	1888	" 9	s	r	Oct. 10	f	5	5	r	c w r	c w r	3 4
107	Morris White	1888	" 9	s	r	Sept. 19	f	4	3	r	c w r	w	9
108	Mountain Rose	1888	" 9	s	g	Aug. 23	f	5	2	r c	c w r	c w r	8
109	Muir	1890	" 6	s	r	Sept. 23	f	7⅛	2	r ov c	y r	y r	6 7
110	Murat	1889	" 9	s	r	Oct. 4	f	7	4	r ov	y r	y r	4 5
111	Mystery	1888	" 7	s	r	Aug. 26	f	5½	2	r c	y r	y r	8
112	N. Am. Apricot	1892	" 9	l	r	Sept. 19	f	4	2	r	y r	y r	6 7

113	Need	1890	"	8	s	r	Aug. 31	f	3⅔	4	r ov	y r	y r	5
114	Neil (Marshall)	1892	"	2	l	r	Oct. 4	f	4½	1	r	c w r	w r	6
115	Newington (free)	1883	"	9	s	r	Sept. 28	f	4½	1	r	c w r	w r	6
116	New Prolific	1894	"	9	s	g	Sept. 7	f	4⅔	7 8	r ov	y r	y r	7
117	Normand	1892	"	9	s	r	Oct. 4	c	5	1	r ov	c w	c w	5
118	Oceana	1895	"	4	s	r	Sept. 12	f	3½	3	r c	y r	y r	6 7
119	Oldmixon (cling)	1888	"	10	s	g	Sept. 19	c	4⅛	4	r ov c	c w r	w r	5
120	Oldmixon (free)	1894	"	9	s	g	Sept. 21	f	4½	1	r c	c w r	c w r	9 10
121	Oriole	1894	"	7	l	r	Sept. 19	s	4	4	ov c	y	y r	4
122	Ostrander	1892	"	8	s	g	Aug. 25	f	5	1	r	y r	y r	5 6
123	Palas	1894	"	8	l	g	Sept. 2	f	3⅔	3	r ov	w r	c w r	5 6
124	Palmerston	1890	"	9	l	g	Sept. 28	c	7	3	r	w r	c w r	7
123	Pansy	1890	"	7	s	r	Aug. 16	f	4½	2	r	y r	y	5 6
124	Pearl	1889	"	7	s	g	Sept. 19	f	5	5	r ov	c w r	w r	7
125	Peninsular Yellow	1894	"	9	s	g	Sept. 20	f	4	1	r ov	y r	y r	5
126	Pickett	1890	"	9	s	r	Oct. 4	c	5½	1	r ov	y r	y r	5 6
127	Pratt	1890	"	9	s	r	Aug. 31	f	3½	4 5	r c	y r	y r	5 6
128	Prince (Rareripe)	1890	"	6	s	g	Sept. 7	f	4	4	r ov	c w r	w r	7 8
129	Princess	1894	"	9	l	g	Sept. 30	f	6	1	r	c w	w r	8 9
130	Princess (Wales)	1889	"	9	l	g	Sept. 9	f	4⅓	4 5	r ov	c w	w	7
131	Prize 1	1890	"	7	s	r	Sept. 26	f	4½	4	r ov c	y r	y r	6
132	Red Cheek (Mel.)	1893	"	8	s	g	Sept. 21	f	4	3 4	r ov	y r	y r	5
133	Red Seedling	1893	"	7	l	g	Aug. 25	f	4	6 7	r	c w r	c w	6
134	Reed	1890	"	9	s	g	Sept. 2	f	4⅔	3	r ov	y r	y r	7 8
135	Reeves (Fav.)	1890	"	9	s	g	Sept. 7	f	4⅔	1	r ov	y r	y r	6 7
136	Ringold	1890	"	9	s	r	Oct. 6	c	4½	2	r ov	c w	w	6 7
137	River Bank	1892	"	9	l	r	July 30	s	4	10	r	g y r	g w	5
138	Rivers	1888	"	6	l	r	Aug. 8	f	5	10	r c	c w r	c w	6 8
139	Roser	1892	"	7	l	r	Oct. 6	f	3½	2	r ov	c w	w	2 3
140	Roseville	1892	"	9	l	g	Sept. 20	c	3½	2	r	c w	c w r	5
141	R. S. Stevens	1891	"	6	s	r	Sept. 9	f	3½	4	r c	y r	y r	6
142	Salway	1890	"	9	s	r	Oct. 10	f	4½	6	r	y r	y r	6
143	Scott	1890	"	8	s	r	Sept. 28	f	5½	4	r	y r	y r	7
144	Sener	1888	"	9	s	r	Sept. 13	f	7	1	r	y r	y r	7 8
145	Shipley	1890	"	9	s	g	Sept. 26	f	5	1	r c	y r	y	4 5
146	Smock (free)	1888	"	9	s	r	Oct. 15	f	6½	1	r ov	y r	y r	5 6
147	Smock x	1892	"	9	s	r	Oct. 1	f	1½	1	r ov	y r	y r	5 6
148	Sneed	1896	"	5	l	r	July 23	s	3	1	r ov	c w r	c w	5 6
149	Snow Late	1890	"	9	s	r	Sept. 2	f	4½	4	r ov c	y r	y r	5 6
150	Southern Early	1890	"	9	s	r	Aug. 29	f	4	5	r c	y r	y r	7 8
151	Spottswood	1894	"	7	l	r	Sept. 16	f	5	6	r ov	c w	w r	6 7
152	Stark Heath	1892	"	3	s	r	Oct. 5	c	4½	2	r ov	c w r	c w	3
153	Stevens Late	1890	"	7	s	r	Sept. 26	f	4½	6	r ov	c w r	c w r	5 6
154	Stevens Rareripe	1892	"	7	s	r	Sept. 26	f	6	5	r ov	c w r	c w r	7
155	St. John	1890	"	9	s	g	Aug. 14	f	6	5	r ov	y r	y r	7 8
156	Strong (Mam.)	1892	"	8	s	g	Sept. 17	f	5⅔	7	r ov	c w r	w r	6
157	Stump (World)	1890	"	7	s	g	Aug. 22	f	4	7	r ov	c w r	c w r	6

TABULATION OF PEACHES—Prunes—1898.—Concluded.

Number.	Names.	Planted.	Bloomed.		Glands.	Ripened.	Adhesion.	Weight of specimen in ounces.	Productiveness—Scale 1 to 10.	Form.	Color.		Quality—Scale 1 to 10.
			Date.	Size.							Skin.	Flesh.	
158	Summer Snow	1894	May 9	1	g	Sept. 27	c	4	8	r c	c w	c w	4 5
159	Surpasse (Mel.)	1890	" 9	s	r	Aug. 29	f	4	2	r ov	y r	y	8
160	Switzerland	1890	" 7	s	g	Sept. 19	f	4½	4	r	c w	c w	5 6
161	Toledo	1894	" 8	1	g	Aug. 19	f	5	5 6	r	c w r	c w r	5 6
162	Toquin	1892	" 10	1	r	Sept. 27	f	3½	3	r	y r	y r	7
163	Townsend	1892	" 8	s	g	Sept. 27	f	5	1	r c	y r	y r	5 6
164	Triumph	1896	" 7	1	g	Aug. 8	f	3½	3	r c	y	y	7 8
165	Troth	1890	" 7	s	g	Aug. 22	f	4	2	r	c w r	w r	5 6
166	Wager	1890	" 9	1	r	Sept. 7	f	4	4	r	y r	y r	5
167	Walker Var.	1893	" 7	s	g	Sept. 28	f	5	4 5	r ov	c w r	c w r	7 8
168	Washington	1890	" 6	s	g	Sept. 7	f	4⅓	3 4	r ov	c w r	w	6 7
169	Willett	1894	" 9	1	r	Sept. 21	f	3	4	r c	y r	y r	5 6
170	Williamson	1892	" 9	s	g	Sept. 27	f	5¼	2	r ov	y r	y r	5 6
171	Wonderful	1890	" 9	s	r	Oct. 3		6	2	r ov	y r	y r	5
172	Worthen	1890	" 6	s	r	Aug. 31	f	3½	3	r ov	y r	y r	8
173	Yellow Rareripe	1888	" 9	s	g	Sept. 23	f	5	4	ov c	y r	y r	3 4

Adrian.—Trees quite vigorous, spreading. Fruit medium to large, roundish, inclined to oval; cavity rather abrupt; suture distinct only near the apex; apex scarcely apparent; color clear yellow, occasionally washed with red, with a moderate pubescence; flesh yellow, red at pit, very juicy, rather firm, mild, vinous, rich; pit free, oval, plump, pointed; quality good; season late September; flowers small or medium; glands globose. As yet not very productive.

Advance.—Trees somewhat spreading. Fruit roundish, slightly enlarged on one side of suture; cavity deep; apex in the depression; suture distinct, more than one-half around; color creamy white, mostly covered and mottled with red; pubescence slight; flesh very juicy, creamy white, rather tender, pleasant and sprightly; pit semi-cling; quality quite good; size medium to large; ripe early August; glands reniform; flowers small.

Albright.—Trees quite vigorous, upright, with a nearly smooth foliage. Fruit medium to large, roundish, slightly pointed; cavity narrow and deep; suture slight, but more than one-half around; apex prominent; color creamy white, sometimes reddened, pubescence slight; flesh very juicy, creamy white, slightly red at the pit, tender, mild, slightly vinous; pit long, oval, free; quality good; season middle to last of September; glands globose; flowers small. Moderately productive.

Allen.—Trees fairly vigorous, roundish, rather upright. Fruit medium size, roundish, slightly ovate; cavity narrow, deep; suture slight, two-thirds around; apex prominent; color yellow, with brownish red cheek, and with considerable pubescence; flesh juicy, pale yellow, tender, high flavor but not rich; pit medium size, oval, plump, free; quality good; ripe early September; moderately productive; foliage slightly glaucous, somewhat crimped; glands reniform; flowers small.

Alpha.—Trees moderately vigorous, roundish, upright. Fruit quite large, roundish and remotely ovate, slightly compressed towards suture; apex sunken; suture indistinct, one-half around; color rich clear yellow, much overspread with rich, dark red, with very slight pubescence; flesh juicy, yellow, firm, pleasant, rich, nearly sweet; pit large, oval, plump, cling; quality good; season middle of September; foliage crimped; glands reniform; flowers small. As yet not very productive.

American Apricot Peach.—Trees quite vigorous, roundish, spreading. Fruit medium size, round, with a medium cavity, and a distinct, slightly sunken apex; suture distinct, one half around; color yellow, very slightly blushed, and with a slight pubescence; flesh very juicy, light yellow, slightly colored at pit; flavor vinous, sprightly, rich, tender; pit medium size, plump, free; quality good; season middle to last of August; moderately productive.

Amelia (of Carolina).—Trees quite productive, spreading, with drooping branches. Fruit large, roundish, tapering slightly towards the apex; cavity medium size; apex small; suture more than one-half around; color creamy white, with a red blush, washed and specked with pale, bright red; pubescence slight; flesh juicy, creamy white, bright red at pit, tender, very mild, vinous, pleasant; pit free; quality quite good; season early September; glands reniform; flowers medium size; not very productive.

Arctic.—Trees quite vigorous, upright, with spreading branches. Fruit medium size, roundish ovate, with a rather broad cavity and a sunken apex; suture indistinct; color light, clear yellow, with a medium pubescence; flesh not juicy, pale yellow, red at pit, mild tender; pit free, oval, pointed, plump; quality fair; glands reniform; foliage partially folded, crimped, slightly waved; season early October. Thus far lacking in productiveness.

Barber.—Trees quite vigorous, with a round head. Fruit rather large, roundish oval; cavity broad, shallow; suture quite distinct, more than one-half around; apex very prominent; color yellow, blushed and mottled with dark red; flesh moderately juicy, yellow, very red at pit, tender, mild, pleasant; pit large, pointed, plump, free; quality good; season middle of September; fairly productive.

Beers Smock.—Trees quite vigorous; head round, open. Fruit large, oval, one side enlarged at suture; cavity narrow, deep; suture distinct more than one-half around; apex a mere point; color light yellow, with a little red on one cheek; flesh moderately juicy, yellow, red at pit, tender, highly vinous; pit large, plump, free; quality good; season early October; fairly productive; glands reniform; flowers small.

Bell Favorite.—Trees fairly vigorous, roundish, upright. Fruit rather large, oval, tapering towards the apex, which is but a slight elevation; cavity rather deep; suture distinct two-thirds around; color yellow, with a dull red cheek, and a slight pubescence; flesh juicy, yellow, red at pit, tender, highly vinous; pit nearly free;

quality fair; season middle to last of September; fairly productive; flowers small, glands globose.

Bishop.—Trees quite vigorous, roundish, upright. Fruit medium to large, round, with a rather deep cavity and a distinct suture, one-half around; apex slight; color creamy white with a rich, dark red blush; flesh juicy, white, with a mild, vinous flavor, tender; pit medium, oval free; quality quite good; season middle of August; quite productive; glands globose; flowers small.

Bonanza.—Trees quite strong, roundish upright; foliage nearly smooth, waved. Fruit medium size, roundish, slightly oblong, narrow towards the stalk and slightly compressed next the suture; cavity narrow, deep; suture extends one-half around, most prominent near the apex which is well marked; color creamy white, slightly red in the sun; pubescence slight; flesh moderately juicy, creamy white, red at the pit, moderately firm, mild, with a slight bitter flavor; pit plump, oval, free; quality rather poor; not very productive, apparently of no value.

Boyle.—Tree rather vigorous, spreading, with drooping branches. Fruit medium to large, round, ovate; cavity broad and deep; apex prominent; suture slight, more than one-half around; color yellow, with a pale red blush; pubescence slight; flesh juicy, yellow, slightly red at the pit, mild, vinous, very pleasant, tender; pit large, plump, roundish oval, pointed, free; glands globose, flowers small or medium; quality quite good; season middle of September; fairly productive.

Brandywine.—Trees rather strong, upright, with round head. Fruit quite large, oblate, ovate, compressed next the suture; cavity wide, deep, quite abrupt; apex very prominent; suture distinct, with one side enlarged; color yellow, washed, marbled and striped with red; pubescence slight; flesh juicy, tender, yellowish red at pit, mild but not rich; pit large, oval, plump, pointed, free; quality good; season last of September; fairly productive; foliage large, crimped, waved; glands globose, flowers medium to small.

Briggs.—Trees fairly strong, roundish, upright. Fruit large, roundish, ovate; cavity broad, moderately deep; apex generally prominent; suture distinct, more than one-half around; color yellow, with a slight blush; pubescence medium; flesh very juicy, tender, yellow, slightly red at pit, mild, rich vinous, sprightly; pit large, oval, plump, pointed, free; quality quite good; season last of August; fairly productive; foliage crimped; glands globose, flowers small.

Brunson.—Trees quite strong, roundish, upright. Fruit large, round, remotely ovate, slightly compressed; cavity small; apex prominent; suture distinct, one-half around; color yellow, faintly blushed with a slight pubescence; flesh moderately juicy, yellow, red at pit, tender vinous, sprightly; pit small, oval, pointed, plump, free; quality good; season middle of September; quite productive. Resembles Kalamazoo, although of a distinct origin.

Brown.—Trees quite strong with a round head. Fruit medium size, round, compressed next the suture; cavity medium; apex in a slight depression; suture disitnct, one-half around; color creamy white, diffused with dull red in the sun; flesh juicy, tender, but moderately firm, creamy white; slightly red at the pit, mild, vinous; pit free; flowers large; glands reniform; quality good; season middle to last of August; quite productive. One of the most promising varieties in its season, owing to its hardiness.

Burke.—Trees moderately strong, upright, with slightly spreading branches. Fruit quite large, roundish, with a shallow, narrow cavity and a depressed apex; suture distinct, one-half around; color creamy white, slightly pink, with a light pubescence; flesh very tender, juicy, mild, sprightly, whitish, quite red at the pit; pit large, oval, long and plump, semi-cling; foliage large, slightly crimped; glands reniform; flowers large; quality good; season early September; not very productive.

California.—Trees quite strong. Fruit large, roundish, regular; cavity deep, abrupt; suture very distinct and more than one-half around; apex very small; color yellow, washed and mottled with red, with considerable pubescence; flesh moderately juicy, yellow, red at pit, rather tender, vinous, pleasant, rich; pit small, plump, oval, pointed free; flowers small, glands reniform; quality quite good; season early October. The trees are quite young and have now borne their first crop.

Chairs.—Trees quite vigorous, roundish, upright. Fruit large, oval to roundish, tapering towards the apex; cavity narrow, deep; apex distinct; suture distinct, more than one-half around, one side enlarged; color pale yellow, with a slight red blush and considerable pubescence; flesh juicy, rather acid, yellow, quite red at the pit, tender; pit long, large, oval, slightly pointed, free; quality good; season early October; quite productive; foliage slightly crimped; glands reniform; flowers small. A promising late variety.

Champion.—Trees quite strong with a round head. Fruit large, roundish, with a broad and deep cavity; suture indistinct, more than one-half around; apex prominent; color clear, light, creamy white, with a beautiful red blush where exposed; pubescence slight; flesh very juicy, red at the pit, very tender, sweet, slightly vinous, rich, nearly white, but with a slight creamy tinge; pit free; quality very good, excellent; fairly productive; season last of August. A handsome peach that is quite promising for home use and worthy of trial as a market sort.

Chili 2 (Engle).—Trees quite vigorous, spreading. Fruit large, rounding remotely ovate, compressed at the suture, which is very slightly marked; cavity rather narorw and deep; apex prominent; color yellow, with a bright red cheek and a slight pubescence; flesh juicy, tender, yellow, red at pit, very mild and rich; pit long, oval, pointed, free; quality quite good; season last of September; quite productive. A seedling from C. Engle, Paw Paw, Mich., which seems to be an improvement over its parent.

Chili 3 (Engle).—Trees fairly strong, spreading. Fruit quite large, roundish, slightly oblong, compressed; cavity medium, narrow; suture slight, one-half around; apex not very prominent; color yellow, with dark red cheek and a moderate pubescence; flesh quite juicy, tender, yellow, slightly red at the pit, mild, nearly sweet; pit rather large, oval, pointed, plump, free; quality quite good; season last of September; quite productive; foliage slightly crimped; glands reniform; flowers small or medium. Another seedling from Mr. Engle, which also has much merit.

Chinese Cling.—Trees rather strong, roundish, upright. Fruit quite large, roundish; cavity narrow; suture and apex distinct; color creamy white, with a slight pubescence; flesh juicy, firm, creamy white, red at the pit, rather acid; pit large, long oval, pointed, cling; quality good; season last of September; as yet not very productive; foliage slightly crimped; glands reniform; flowers large.

Cleffey *Allen*.—Trees quite strong, roundish, upright. Fruit medium to large, roundish, with a broad, deep cavity; suture slight, one-half around; apex indistinct; color yellow, with a brownish red cheek and a plentiful pubescence; flesh juicy, tender, yellowish red at the pit, mild, vinous, not rich; pit oval, plump, pointed, free; quality good; season middle of September; fairly productive; foliage crimped; glands reniform; flowers small or medium.

Columbia.—Trees rather strong, upright, spreading. Fruit medium to large, roundish, slightly elongated; cavity broad, deep; suture distinct, one-half around; apex very prominent; color yellow, nearly or quite covered with stripes and marblings of dull red; pubescence plentiful; flesh yellow, more or less red near the surface, and slightly red at the pit, tender, juicy, mild, with more or less bitterness; pit small, round, plump, pointed, free; quality quite poor; fairly productive; foliage slightly crimped, waved; glands reniform; flowers large; season early October. The quality is too poor to make it of any value.

Connecticut.—Trees fairly vigorous. Fruit medium size, roundish, slightly compressed and enlarged at one side of suture; cavity broad, deep; suture distinct, more than one-half around; apex prominent, color yellow, nearly overspread with red; flesh lacking in juice, tender, very mild and rich, yellow, red at the pit, which is small and free; quality quite good. The trees were planted in 1896, and only bore a few fruits last year.

Connett.—Trees quite vigorous. Fruit large, roundish, oval, compressed; cavity small, deep, abrupt; suture very marked, more than one-half around; apex in a depression; color creamy white, faintly mottled and washed with light red; very handsome; flesh quite juicy, creamy white to pit, tender, luscious, sprightly, vinous; pit oval, plump, semi-cling; quality quite good; fairly productive. A very handsome and delicious peach which is likely to prove a valuable sort for home use.

Coolidge Mammoth.—Tree quite vigorous, with a roundish, upright head. Fruit large, roundish, ovate; cavity rather narrow and deep; apex very prominent; suture distinct, more than one-half around; color clear, bright yellow, with a bright blush and a medium amount of bloom; flesh juicy, yellow, red at pit and with a mild, vinous and sprightly flavor; pit large, oval, pointed, free; quality quite good; season middle of September. Foliage crimped, with globose glands; flowers small.

Corner.—Tree quite vigorous, with a round head. Fruit medium size, oval or ovate; cavity deep; apex prominent; suture distinct, more than one-half around, color yellow with bright blush and a moderate amount of bloom; flesh moderately juicy, yellow, red at pit, fairly tender and with a mild, almost sweet, but not rich flavor; pit free, oval, pointed quality good; season early September. Foliage crimped with renoform glands; flowers small or medium.

Crosby.—Tree rather vigorous, with a spreading, drooping habit. Fruit medium to large, roundish; cavity narrow and deep; apex depressed; suture distinct, two-thirds around; color yellow with a slight bloom; flesh moderately juicy, yellow, quite firm, with a mild, vinous flavor; pit free; quality good; season middle to last of September. The fruit is generally more or less mottled with red and with a deep rather dull red cheek. The pit is small, nearly pointed, plump. Foliage nearly smooth with reniform glands; flowers small.

Crothers.—Tree strong with drooping branches. Fruit medium size, varying from round to roundish ovate; cavity medium; apex a slight elevation in the suture, which extends more than one-half around; color creamy white with a bright blush in the sun and with a slight bloom; flesh very juicy, creamy white, red at pit, tender, mild, vinous and pleasant; pit large, roundish, oval, pointed, free; quality, good; season last of September and first of October. Quite productive. Glands globose; flowers small or medium.

Dennis.—Tree fairly strong, spreading, with drooping branches. Fruit medium size, roundish; cavity medium; apex a slight elevation in the sature, which is distinct two-thirds around; color yellow, with a slight bloom; flesh juicy, yellow, tender, highly vinous; pit free, large, roundish, oval; plump; quality, good; season early September. Foliage smooth with globose glands; flowers large.

Diamond.—Tree quite strong, roundish, somewhat drooping. Fruit large, roundish, slightly ovate; cavity narrow, deep; apex scarcely distinct; suture deep, more than one-half around; color pale, clear yellow, often with a faint red cheek and a medium amount of bloom; flesh juicy, pale yellow, red at pit, firm and vinous in flavor; pit large, oval, plump, partially free; quality fair; season last of September. Flowers small with globose glands. Usually a large, handsome variety but until fully ripe the adherence of the pit is such as to class it with the clings.

Druid Hill.—Tree quite vigorous, with a roundish, somewhat spreading head. Fruit large, roundish, inclining to ovate; cavity broad and deep; apex distinctly pointed, suture, slight more than one-half around; color creamy white, washed, mottled and specked with bright red and with a very slight bloom; flesh moderately juicy, whitish, slightly red at pit, tender, vinous, and with a sprightly flavor; pit free, quality quite good; season last of September and first of October. Glands globose; flowers small.

Dumont.—Trees quite strong, with upright branches. Fruit medium to large, roundish oval, much compressed; cavity narrow, deep; suture distinct more than one-half around; apex slight; color yellow, much shaded with red and with a heavy bloom; flesh moderately juicy, yellow, quite red at pit, tender, sweet; pit free; quality rather poor; season middle of September. Flowers small; glands reniform. The quality of the fruit is such that it is not likely to prove of value.

Dunlap.—Tree quite strong, rather spreading. Fruit large, roundish, remotely ovate; cavity wide, deep; apex slight; suture distinct, two-thirds around; color yellow, nearly covered with dark red; flesh yellow, red at pit, quite juicy, tender and with a rich, vinous flavor; pit large, plump, free; quality quite good, season last of August. Foliage large, slightly crimped, with globose glands; flowers small. One side of the fruit is often enlarged.

Early Barnard.—Tree quite strong, with a roundish, upright head and slightly spreading branches. Fruit rather large, roundish; cavity narrow and deep; apex slight; suture more than one-half around; color yellow, nearly covered with dark red and with a medium bloom; flesh moderately juicy, yellow with much red at pit, moderately tender, nearly sweet; pit free; quality good; season last of August. Foliage is not crimped or folded; glands reniform; flowers small; pit rather large, plump, roundish, oval, pointed.

Early Crawford.—Tree quite strong with a roundish top and upright branches. Fruit large, roundish, slightly elongated; cavity broad; apex usually slight; suture distinct, more than one-half around; color clear bright yellow, with a red cheek and a light bloom; flesh very juicy, yellow, red at pit; fibrous, sweet, vinous, rich; pit free; quality quite good; season last of August. The fruit is sometimes compressed near the suture and is often overspread with many bright red specks. Pit large, roundish oval, pointed. Foliage large, crimped; glands globose; flowers small. One of the largest and most desirable varieties for use upon rather heavy soil in elevated locations. Its principal fault is that it starts readily in the winter or spring and its flower buds are often injured as a consequence.

Early Crawford Seedlings, Nos. 1 and 3, from C. Engle, Paw Paw, greatly resemble the parent, but do not quite equal it in quality.

Early Michigan.—Trees quite strong, spreading. Fruit large, round; cavity broad; apex depressed; suture distinct, more than one-half around; color creamy, mostly overspread and dappled with dark red and with a medium bloom; flesh whitish with a little red at pit; flavor sweet, mildly vinous, rich; texture tender, juicy; pit large, plump, free; quality quite good; season middle of August. Flowers large; glands reniform. One of the most valuable of the medium early varieties.

Ede (Captain).—Tree quite strong, upright with drooping branches. Fruit medium to large, roundish oval; cavity narrow, deep; apex slight; suture more than one-half around; color pale yellow with a dull red cheek and with slight bloom; flesh moderately juicy, yellow, red at pit, tender and with a vinous flavor; pit oval, pointed, free; quality good; season middle to last of September. Glands globose; flowers small.

Eldred (Cling).—Trees strong, roundish upright. Fruit rather large, roundish ovate, enlarged on one side; cavity narrow and deep; apex slight; suture distinct, more than one-half around; color creamy white, blushed, with a slight bloom; flesh juicy, creamy white, firm, mild and pleasant; pit roundish oval, cling; quality fair; season early September. Foliage crimped, waved and folded; glands globose; flowers small or medium. The above name was supplied by S. B. Heiges, ex-pomologist of the U. S. Department of Agriculture.

Ellison.—Trees fairly strong, upright. Fruit medium size, roundish, ovate; cavity narrow, shallow; suture distinct, more than one-half around; apex in a slight depression; sometimes quite prominent; color yellow, with a large, dark red cheek and a thin bloom; flesh moderately juicy, yellow, red at pit, moderately tender, with a mild, vinous, sprightly and rather acid flavor; pit free, small, rather plump; quality fair to good; sometimes with a bitter taste at pit; season October first; foliage crimped, waved; glands reniform, flowers small. It seems to be a hardy and rather productive variety.

Engle (Mammoth).—Trees quite strong, upright. Fruit medium to large, roundish, ovate; cavity medium size; apex a slight elevation in the suture, which is distinct and slightly more than one-half around; color yellow, slightly reddened in the sun; bloom light; flesh juicy, yellow, a little faint red at the pit; tender, rich, mild, nearly sweet; pit free, rather large, oval, pointed; quality quite good; season early September; foliage large; glaucous, glands globose; flowers small or medium. Generally quite productive and a valuable variety for either home use or market.

Ford (New).—Trees moderately vigorous, upright, with drooping branches. Fruit, large, roundish; cavity medium size; suture more than one-half around, with a slight point at the apex; color yellow, blushed with red in the sun, with a very thin bloom; flesh moderately juicy, yellow, tinged with red at pit; quite firm and with a mild, early sweet flavor; pit free, oval, plump, pointed; quality good; season early September; glands globose; flowers small or medium.

Ford Red.—Trees quite strong, with a roundish, upright head. Fruit medium size, slightly enlarged at the suture, generally oval; cavity narrow, deep; apex slight, interrupting the suture, which is quite distinct; color creamy white with a slight blush and a moderate amount of bloom; flesh juicy, rich, creamy white, red at pit, tender and with a mild, nearly sweet flavor; pit free, oval, pointed, quite plump, with the flesh surrounding it rather bitter; quality good; season early September; fairly productive.

Ford 1.—Trees quite strong, spreading. Fruit medium to large; roundish, elongated; cavity small, deep, abrupt; suture very slight; apex a mere point in a depression; color creamy white, delicately washed with bright-red and with a light bloom; flesh creamy white, slightly tinged with red at pit, very juicy, tender, sprightly, very pleasant, vinous; pit very plump, semi-cling; quality good; season middle or last of August; quite productive.

Ford 2.—Trees quite strong with roundish head. Fruit medium to large, roundish, remotely ovate, slightly compressed at suture which is indistinctly marked; cavity broad, rather deep; apex indistinct; color yellow, with a faint red cheek; flesh juicy, yellow, red at pit, tender, vinous; pit medium size, pointed, oval, plump, free; quality good; season last of September; flowers small; glands globose. The trees as yet have not been very productive.

Ford 3.—Trees quite strong. Fruit medium size, roundish, slightly compressed at the suture; cavity narrow, moderately deep; suture slight; apex indistinct; color greenish yellow, with a thin bloom; flesh moderately juicy, white, slightly tinged with red at the pit, rather tender, mild, slightly vinous in flavor; pit very plump, pointed, free; quality rather poor; season middle to last of October; glands reniform; flowers small. Rather late for this climate.

Fox.—Trees fairly vigorous with a round head. Fruit medium size, roundish, slightly inclined to ovate; cavity medium; suture slight; apex prominent; color creamy white, with a faint blush; flesh quite juicy, yellowish-white, red at pit, very tender, and with a vinous, sprightly flavor; pit nearly round, pointed, free; quality fair; season first of October; foliage crimped, waved; glands globose; flowers small.

Geary (Hold On).—Trees quite strong, with drooping branches. Fruit large, roundish to roundish ovate; cavity broad; suture distinct, more than one-half around, with an enlargement at one side; apex very small; color pale yellow, with a blush in the sun; flesh rather dry, yellow, red at pit, quite firm, sprightly, vinous; pit large, long, oval, pointed, free; quality fair to good; season early October; foliage slightly crimped and waved; glands reniform; flowers small. The trees have generally been quite productive.

Globe.—Trees fairly vigorous, with stout, upright branches. Fruit quite large, round or slightly ovate; cavity broad, deep; suture slight, two-thirds around; apex not very distinct; color yellow, with a slight red cheek and a thin bloom; flesh juicy, yellow, mild, vinous, sprightly, tender; pit large, oval, plump, free; quality good; season middle of October; foliage slightly crimped; glands globose, flowers small. Usually lacking in productiveness, although the fruit is large and handsome.

Gold Drop.—Trees fairly vigorous, drooping. Fruit medium size, roundish, slightly inclined to ovate; cavity broad, shallow; suture only marked near the apex, which is slightly developed; color rich yellow, occasionally with a light red cheek in the sun and with a thin bloom; flesh moderately juicy, yellow, tender, mild, vinous, almost sweet; pit small, oval, pointed, free; quality quite good; season middle to the last of September; foliage slightly crimped, waved; glands reniform; flowers large. The trees are usually quite productive, and unless the fruit is well thinned it is of rather small size.

Grant (General).—Trees fairly strong, roundish, upright. Fruit medium to large, roundish, tapering towards the apex; cavity narrow, deep; suture distinct, two-thirds around; apex indistinct; color pale creamy-white with a mottled cheek and a thin bloom; flesh moderately juicy, creamy white, red at pit, firm, mild, vinous, pleasant; pit medium size, roundish oval, pointed, plump, cling; quality good; season first of October; foliage crimped; glands reniform; flowers small. The fruit is often slightly compressed at the suture and is one-sided near the apex.

Great Western.—Trees quite strong, with a roundish head. Fruit medium to large, roundish or slightly ovate; cavity narrow, deep; suture more than one-half around and quite distinct near the apex, which is prominent; color creamy white with a medium amount of bloom; flesh very juicy, creamy white to the pit, which is roundish oval, pointed, plump, cling; texture firm; flavor mild, slightly bitter; quality rather poor; season early to middle October; foliage slightly crimped, folded, waved; flowers small; glands reniform. The trees have been only moderately productive.

Gudgeon.—Trees quite strong, roundish, upright. Fruit medium to large, roundish; cavity medium; suture slight more than one-half around; apex usually quite prominent; color creamy white with a bright red blush; flesh juicy, white, slightly red at pit, rather tender, and with a mild, sprightly flavor; pit free, oval, pointed; quality fair to good; season first of October; foliage slightly crimped and waved; glands reniform; flowers small. Not very productive.

Haas.—Trees fairly strong, moderately spreading. Fruit medium to large, roundish; cavity, deep; suture scarcely distinct; color creamy white, partially washed and striped with red, and with a very light bloom; flesh yellowish white, juicy, tender, sweet or slightly vinous; pit small, oval, plump, free; quality fair to good; season first to middle of August; glands reniform; flowers large. The trees have been quite productive the past season.

Hale.—Trees fairly strong, spreading. Fruit medium size, roundish; cavity quite deep, abrupt; suture well marked; apex a mere point in the suture; color creamy white with a bright cheek and a very thin bloom; flesh moderately juicy, creamy white, tender, pleasant, sprightly; pit semi-cling; quality fair to good; season middle of August. Trees are generally hardy, comparatively free from the attack of curl leaf and quite productive, although somewhat subject to brown rot.

Hale X Oblong.—Trees moderately vigorous, spreading. Fruit rather large, round; cavity medium; apex slightly depressed; suture distinct one-half around; color creamy white, nearly covered with dark red and with a slight bloom; flesh juicy, tender, of a faint creamy-white color; moderately firm, sprightly, vinous; pit rather large, oval, plump, slightly adherent; quality good; season early August. The trees have been even more productive than Hale and the fruit is generally much larger and the pit less adherent. Several specimens weighed from nine to ten ounces each.

Hance (Golden).—Trees fairly strong, upright. Fruit medium to large, roundish; cavity broad; suture indistinct, except near the apex, which is a mere point in the suture; color yellow, with a dark cheek in the sun and with a moderate amount of bloom; flesh juicy, yellow, red at pit, tender, mild, vinous; pit free; quality good; season early September; foliage, crimped; glands globose; flowers small. Thus far only moderately productive.

Hance Smock.—Trees quite strong, roundish upright. Fruit large, roundish to roundish oval; cavity narrow, deep; suture deep, especially near the apex, two-thirds around; apex slight; color pale yellow, with a marbled red cheek where exposed; flesh moderately juicy, yellow, red at pit; tender, mild, vinous, sprightly; pit large, oval, pointed, free; quality good; season first of October; quite productive; foliage crimped, waved, folded.

Husted No. 101.—Trees quite strong, with drooping branches. Fruit medium size, oval, compressed at suture; cavity narrow, rather deep; apex distinct but not prominent; suture slight except at apex; color yellow, washed with red; flesh rather dry, yellow, red at pit, quite firm, fine grained, sweet, but not rich; pit free medium size, plump, oval, pointed; quality fair; season middle of September. The trees are too young as yet to judge of their productiveness.

Husted No. 130.—Trees of this variety are now known as Oceana. Growth quite strong, roundish upright. Fruit large, roundish, compressed at suture; cavity medium, suture distinct, more than one-half around; apex a mere point; color light, clear yellow with an abundance of bloom; flesh moderately juicy, yellow, red at pit, tender, vinous, sprightly, rich and pleasant; pit free, quite plump, oval, pointed; quality quite good; season early September. The young trees have thus far shown themselves to be productive. Where the specimens are fully exposed many of them have their surface marbled and streaked with red.

Husted No. 700.—Trees received under the above number have been given the nam of Triumph. Growth quite vigorous, roundish, rather upright. Fruit medium to large, roundish, slightly oblate; cavity rather deep, abrupt; suture indistinct except near the apex, which is slightly sunken; color yellow, marbled and indistinctly striped with red; flesh tender, juicy, light yellow, firm with a vinous, sprightly and rich flavor; pit semi-cling but becoming nearly free when the specimens are fully ripe; quality very good; season middle of August. The trees appear to be early and abundant bearers. The fruit which ripens a few days after Alexander, is of very good size when the trees are properly thinned.

Hyatt.—Trees fairly strong, roundish, spreading. Fruit medium to large, round, tapering slightly towards the apex which is generally somewhat elevated; cavity medium; suture distinct, extending more than one-half around; color creamy white, overspread with two shades of red in the sun and with a very thin bloom; flesh juicy, tender, creamy white, moderately firm, and with a sprightly, vinous flavor; pit slightly adherent, medium size, plump, free when fully ripe; quality good; season early August; quite productive.

Hynes (Surprise).—Trees fairly strong, roundish with somewhat drooping branches. Fruit medium size, roundish; apex sunken; suture a mere line one-half around; cavity medium size and depth; color creamy white, mottled, washed and faintly striped with red and a medium amount of bloom; flesh very juicy, tender, creamy white, sprightly, vinous, pleasant; pit semi-cling; quality good; season early August. The trees seem quite productive.

Hyslop.—Trees fairly strong, upright with drooping branches. Fruit medium to large, roundish with a rather narrow and deep cavity; apex fairly prominent; suture indistinct except near the apex; color light creamy white, striped or mottled with bright red in the sun and with a very thin bloom; flesh juicy, light cream-white to the pit, firm and with a mild and pleasant flavor; pit medium size, rather plump, oval, pointed, cling; quality fair; season early October.

Infant Wonder.—Trees fairly strong, spreading. Fruit medium to large, roundish ovate; cavity narrow, deep; apex a slight interruption in the suture, which is rather indistinct; color creamy white with a slight blush and a thin bloom; flesh juicy, rich creamy-white, much reddened at the pit, tender, vinous, with a slight bitterness; pit rather large, oval pointed, free; quality good; season last of August; glands globose; flowers small; fairly productive.

Iron Mountain.—Trees fairly strong, upright. Fruit quite large, oval, slightly compressed near the suture; cavity broad, shallow; suture distinct, one-half around, with an enlargement at one side; apex an abrupt prominence at the end of the suture; color creamy-white, with a medium amount of bloom; flesh juicy, greenish white to the pit, mildly vinous and quite pleasant for so late a variety; flowers small; glands reniform; foliage crimped, slightly folded and waved; quality fair; season early October. Rather late for this section.

Jacques Late.—Trees fairly strong, roundish, upright. Fruit medium to large, roundish, slightly ovate; cavity broad, shallow; suture slight, two-thirds around; apex very small; color creamy-white with a light red blush and thin bloom; flesh moderately juicy, creamy-white, red at pit, tender, rather acid, slightly bitter; pit plump, roundish, oval, pointed, free; quality good; season last of September; foliage large, crimped; glands globose; flowers small.

Jersey Yellow.—Trees quite strong, spreading. Fruit medium size, roundish oval, enlarged at one side of suture; cavity narrow, deep; apex fairly distinct; suture well marked more than one-half around; color clear yellow, slightly blushed, with an abundance of bloom; flesh moderately juicy, yellow, red at pit, quite tender, mild, with a slightly bitter flavor; pit medium size, rather plump, free; quality fair; season early October; flowers small; glands reniform.

Jones.—Trees quite strong, roundish upright. Fruit rather large, inclined to ovate; cavity rather deep; apex prominent; suture distinct, two-thirds around; color yellow, with a cheek mottled with dark red and with a medium amount of bloom; flesh juicy, yellow, red at pit, tender, vinous; pit long, oval, nearly free; quality fair to good; season middle of September; foliage much crimped; glands globose; flowers small.

June Rose.—Trees quite strong with roundish upright heads. Fruit rather large, roundish ovate; cavity medium; apex prominent; suture well marked one-half around; color pale creamy-white with a bright red cheek and thin bloom; flesh very juicy, whitish, slightly red at pit, tender, vinous, high flavor; pit medium size, oval, free; quality quite good; season last of August; foliage slightly crimped; glands globose; flowers small. A large and handsome white peach, which has generally been quite productive.

Juno.—Trees fairly strong. Fruit large, roundish, occasionally compressed at suture; apex prominent; cavity small, deep; suture a mere line more than one-half around; color clear yellow washed with red and with a considerable bloom; flesh moderately juicy, yellow, slightly red at pit, rather firm, mild, quite rich and pleasant; pit cling; quality good; season early October.

Kalamazoo.—Trees fairly vigorous, roundish with slightly drooping branches. Fruit medium to large, often slightly compressed at suture; apex well marked but not prominent; cavity medium; suture slight, but extending more than one-half around; color yellow, slightly washed and striped with red in the sun and with a thin bloom; flesh juicy, yellow, slightly reddened at pit, tender, vinous, sprightly, rather rich; pit rather large, oval, pointed, plump, free; quality quite good; season middle of September; foliage slightly crimped; glands reniform; flowers small. The trees are generally quite hardy and productive and it is one of the most valuable varieties of its season.

Kallola.—Trees fairly strong, roundish upright. Fruit medium to large, roundish oval; cavity medium, rather deep; apex slightly sunken; suture distinct at apex; color creamy-white with a thin bloom; flesh very juicy, faint creamy-white, red at pit, very tender and with a vinous, slightly bitter flavor; foliage crimped and slightly waved; glands reniform; flowers large; quality fair; season middle of September; fairly productive.

LaFleur.—Trees fairly strong, roundish upright. Fruit medium size, oval; cavity narrow; apex distinct; suture well marked more than one-half around; color yellow, nearly covered with dark red and with red stripes; bloom quite dense; flesh juicy, pale yellow, tender and with a mild, vinous flavor; pit small, oval, pointed, free; quality fair; season late September; flowers large; glands reniform; foliage slightly crimped, folded and waved.

Late Barnard.—Trees quite strong, roundish upright with drooping branches. Fruit medium to large, roundish oval; cavity narrow, rather deep; suture distinct more than one-half around; apex prominent; color yellow with a dark red cheek and a moderate amount of bloom; flesh fairly juicy, bright yellow, red at pit, firm, sweet, rich and pleasant; pit large, plump, pointed, free; quality quite good; season middle of September. The trees are fairly productive and the fruit is often slightly compressed at one side near the suture.

Late White.—Trees fairly vigorous, drooping. Fruit medium to large, roundish oval, slightly compressed near the suture; cavity small, shallow; apex prominent; suture well marked one-half around; color creamy-white, bright red in the sun and with a thin bloom; flesh moderately juicy, pale creamy-white, red at pit, tender and with a sprightly, vinous flavor; pit large, plump, roundish, oval, pointed, free; quality good; season last of September; quite productive.

Lemon Free.—Trees quite strong, roundish. Fruit large, round, remotely ovate; cavity open rather deep; apex generally well marked; suture indistinct one-half around, with the flesh at one side enlarged; color light yellow, with a greenish white tinge, and with a thick bloom; flesh pale yellow to the pit; somewhat lacking in juice, tender and with a vinous flavor; pit oval, pointed, free; quality fair. Season early October, fairly productive. Flowers large, glands reniform, foliage slightly crimped, folded and waved. Valuable for canning.

Lewis.—Trees fairly strong with rather slender branches. Fruit medium to large, round, compressed at suture; cavity medium size; suture distinct one-half around; apex a slight depression; color creamy-white, overspread mottled and specked with light and dark red and with a thin bloom; flesh juicy, creamy-white, slightly red at pit, tender, vinous, sprightly and pleasant; pit medium size, plump, pointed, free; foliage large; glands reniform; flowers large; quality good; season middle of August. Trees quite hardy and productive and the fruit when thinned is of good size. A valuable market variety.

Longhurst.—Trees quite strong with a roundish head. Fruit medium to large oval, enlarged at one side of the suture; cavity rather broad; suture indistinct; apex very prominent; color yellow with a slight red blush and a medium amount of bloom; flesh moderately juicy, yellow, red at pit, tender, fibrous, and with a vinous, sprightly and rather rich flavor; pit oval, pointed, free; flowers large; glands globose; quality good; season last of September; quite productive.

Lorentz.—Trees very strong, spreading. Fruit medium size, roundish, enlarged at one side of the suture; cavity narrow, deep; apex sunken; suture slight more than one-half around; color yellow, slightly blushed and with a moderate amount of bloom; flesh fairly juicy, yellow, red at pit, tender, mild, vinous and pleasant; pit medium size, rather plump, free; glands reniform; quality good; season early October.

Lovell.—Trees fairly vigorous, drooping. Fruit medium size, roundish, compressed; cavity narrow, deep; suture distinct, two-thirds around; apex a slight interruption of the suture; color bright yellow with a faint marbled blush and thin bloom; flesh juicy, yellow to the pit, tender and with a vinous flavor; pit small, roundish oval, free; foliage crimped; glands globose; flowers small; quality quite good; season middle to last of September; fairly productive.

Lovett White.—Trees moderately strong, roundish, upright. Fruit large, roundish; cavity narrow, shallow; suture distinct more than one-half around; apex quite prominent; color creamy white, with considerable bloom; flesh quite juicy, pale creamy white to the pit, tender, sprightly and rather rich; pit free; foliage crimped; glands reniform; flowers small; quality quite good; season middle to last of September. The trees seem quite productive and it is a valuable white peach for canning purposes.

Magdala.—Trees quite strong, roundish upright with drooping branches. Fruit medium size, roundish; cavity rather small; suture distinct; apex rather prominent; color creamy white, with a bright crimson blush and very thin bloom; flesh very juicy, creamy white, slightly red at pit, exceedingly tender and with a vinous rich flavor; pit small, oval, very plump, free; foliage crimped; glands reniform; flowers small; quality quite good; season last of August and first of September. The trees are moderately productive and although of little value for market, it is a promising dessert variety.

Mammoth Heath.—Trees of rather weak growth, spreading. Fruit medium size, roundish, cavity narrow, deep; apex distinct; suture a mere line except at apex; color clear yellow with a thin bloom; flesh juicy, yellow, firm, very mild; pit roundish oval, rather plump, cling; foliage slightly crimped and waved; flowers large; glands reniform; quality fair; season last of September; quite productive. The trees may perhaps be untrue to name.

Marshall.—Trees fairly vigorous, roundish, upright. Fruit medium to large, roundish, slightly oblong; cavity narrow and deep; apex a mere point in the suture, which is usually distinct two-thirds around; color pale yellow, slightly mottled with red and with a thin bloom; flesh moderately juicy, yellow, much reddened at pit, rather firm and with a flavor slightly inclined to acid; pit free; foliage nearly smooth; glands reniform; flowers small or medium; quality good; season last of September; quite productive and a promising late yellow variety.

McCollister.—Trees fairly strong, upright. Fruit quite large, varying from oval to roundish ovate; cavity rather broad and deep; suture of medium depth, extending one-half around; apex very prominent; color yellow with a dark red cheek and an abundance of bloom; flesh moderately juicy, yellow, red at pit, fairly tender and with a sprightly, vinous flavor; pit large, long, plump and free; foliage slightly crimped; glands reniform; flowers small; quality good; season last of September; fairly productive. The size and handsome appearance of the fruit makes it a desirable sort for late market.

McKevitt.—Trees quite strong, roundish, upright. Fruit quite large, roundish, oval; cavity narrow and deep; apex prominent; suture a line extending rather more than one-half around; color creamy white, with a cheek marbled with bright red, and a thin bloom; flesh moderately juicy, pale creamy white, faintly reddened at the pit; firm and mild; pit long, oval pointed, cling; foliage; glands globose; flowers small; quality fair; season last of September.

Milhizer.—Trees rather strong, upright. Fruit medium size, roundish; cavity narrow, deep; apex a point in the suture which is very indistinct except near the apex; color white with a slight tinge of red, and with a medium amount of bloom; flesh moderately juicy, white to the pit, tender and vinous; pit oval, pointed, free; flowers small; glands globose; quality good; season early October.

Minnie.—Trees quite strong, drooping. Fruit large, roundish; cavity broad and shallow; apex a mere point; suture distinct one-half around; color creamy white with a dappled red cheek; flesh very juicy, creamy white, red at the pit, moderately firm, vinous and pleasant; pit rather large, free; foliage crimped; glands reniform; flowers small; quality good; season last of August; quite productive.

Mountain Rose.—Trees fairly strong, spreading. Fruit large, roundish, tapering slightly towards the apex and slightly compressed next to the suture; cavity deep; abrupt; suture moderate, two-thirds around; apex a point in the suture; color creamy white, blushed and sprinkled with light red spots; flesh very juicy, creamy white, reddened at the pit, tender, melting and with a mild, vinous flavor; pit large, plump, free; quality quite good; season middle to last of August. Although not especially valuable for market, its high quality makes it a valuable kind for home use.

Moore.—Trees quite strong, upright. Fruit medium to large, round, slightly ovate with a broad cavity; suture only distinct near the apex, which is rather prominent; color pale creamy white with a bright blush and an abundance of bloom; flesh juicy, white, red at pit, tender, sprightly excellent; pit rather small, oval, pointed, free; quality good; season middle of September.

Morris County—Trees fairly strong, spreading. Fruit medium size, roundish; cavity medium; suture a line except at the apex; apex fairly prominent; color creamy white with a slight red cheek and a fair amount of bloom; flesh moderately juicy, creamy white, slightly red at the pit, tender and with a mild, slightly bitter flavor; pit oval, pointed, free; foliage nearly smooth, slightly waved; glands reniform; flowers small; quality fair; season middle of September.

Morris White.—Trees quite strong, roundish upright. Fruit quite large, roundish; cavity medium depth; suture slight; apex medium; color creamy white, occasionally blushed; flesh juicy, white to the pit, tender, vinous, rich and excellent; pit medium size, oval, plump, free; glands reniform; flowers small; quality quite good; season early September. Generally fairly productive and a valuable white canning peach.

Muir.—Trees quite strong, roundish upright. Fruit quite large, roundish, oval, slightly compressed; cavity broad and rather deep; suture distinct, one-half around; apex generally prominent; color yellow with a slight red cheek, splashed and striped with dark red; flesh very juicy, yellow, much reddened at the pit, tender, vinous and sprightly; pit very large, roundish, oval, plump; foliage crimped; glands reniform; flowers small; quality good; season middle of September. Generally quite productive and a promising variety.

Murat.—Trees fairly strong, spreading. Fruit quite large, roundish, inclining to oval and slightly compressed; cavity narrow, moderately deep; apex a mere point in the suture, which is scarcely perceptible except at that point; color light yellow washed with red and with a fair amount of bloom; flesh moderately juicy, yellow, red at pit, rather coarse and with a mild, slightly acid and bitter flavor; pit very large, plump, pointed, free; glands reniform; flowers small; quality rather poor; season early October; fairly productive.

Mystery.—Trees moderately vigorous. Fruit large, roundish, compressed; cavity narrow and deep; suture indistinct; apex depressed; color dark yellow, with a very dark red cheek and with red spots; flesh juicy, yellow, red at pit, rather coarse but tender and with a pleasant, vinous, rich flavor; pit free; quality good; season last of August. A fairly productive and promising variety.

Need.—Tree moderately strong, round, upright. Fruit medium size, roundish, slightly ovate; cavity medium; apex a mere point; suture two-thirds around, not deep; flesh yellow, red at pit, very juicy, rather tender, with a mild, vinous flavor, sometimes slightly bitter; skin yellow, generally with a red cheek and an abundant bloom; quality fair; season last of August.

Neil (Marshal).—Tree moderately vigorous, drooping, with the foliage slightly crimped. Fruit medium size, roundish, irregular; cavity rather narrow and deep; apex slightly sunken; suture distinct only at the apex; color yellow, with a light marbling of red and a thin bloom; flesh moderately juicy, yellow, tender, mild and pleasant; pit medium size, oval roundish, free; quality fair; season early October; flowers large; glands reniform. The trees as yet seem somewhat lacking in productiveness.

Newington (Free).—Tree fairly strong, roundish upright. Fruit medium to large, roundish; cavity medium size; apex slightly elevated; suture distinct only at the apex; color creamy-white with a dark red blush and a thin bloom; flesh moderately juicy, white, slightly red at pit, very tender and with a vinous and pleasant flavor; pit roundish, oval, plump, free; quality good; season last of September; flowers small; glands reniform; foliage crimped, nearly flat.

New Prolific.—Tree very vigorous, roundish upright. Fruit large, roundish, slightly oval; cavity narrow, deep; apex generally well marked; suture deep, more than one-half around; color yellow, with a slight dull red cheek and a moderate amount of bloom; flesh juicy, yellow, with a very small amount of red at pit; texture firm; flavor delicate, sprightly, vinous; pit free; quality quite good; season early September. Although quite young the trees seem very productive, and, as the fruit is of good size, handsome appearance and excellent flavor, it is a promising variety either for home use or market.

Normand.—Tree quite strong, upright, foliage slightly waved, but nearly smooth. Fruit medium size, roundish varying to oval; cavity narrow, deep; apex a slight projection; suture shallow more than one-half around; color creamy-white, with a thin bloom; flesh creamy-white to the pit, firm, quicy juicy and with a mild flavor; pit slightly adherent; quality fair; season early October.

Oldmixon (Free).—Tree quite vigorous, spreading. Fruit medium to large, roundish; cavity narrow; suture slight; apex not marked; color creamy-white, generally marbled with red, and with a thin bloom; flesh juicy, creamy-white, red at pit, tender with a sprightly, vinous flavor; pit oval, pointed, plump, free; flowers small; glands globose; quality quite good; season middle of September. One of the best of the old varieties, but as it ripens at the same time as several yellow sorts it has been generally discarded as a market sort.

Oriole.—Tree spreading, drooping, quite strong. Fruit medium size, oval, with one side enlarged; cavity broad and deep; suture slight, more than one-half around; apex a slight enlargement in the suture; color pale yellow with thin bloom; flesh very juicy, pale yellow, with a small amount of red at pit; tender, quite vinous; pit large, plump, oval, cling; only moderately productive; quality fair; season middle of September.

Ostrander.—Tree moderately strong, roundish, upright. Fruit medium size, roundish, remotely conical; cavity medium size; suture distinct, more than one-half round; apex slight; color yellow, with a dark red cheek; flesh tender, juicy, yellow, red at pit, rather fibrous and slightly bitter, especially near pit, which is oval, pointed, plump, free; foliage large; glands globose; flowers small; quality fair; season last of August.

Pallas.—Tree fairly strong, upright, spreading. Fruit medium size, roundish oval; apex very prominent; suture distinct, one-half around; color greenish, blushed with dull red, and with a medium amount of bloom; flesh very juicy, creamy white, red at pit, quite tender, sweet and pleasant except for a silght bitterness at pit, which is large, oval, plump, free; quality fair to good; season early September; fairly productive.

Palmerston.—Tree quite strong, roundish upright with a slightly crimped foliage. Fruit large, roundish; cavity broad, deep; apex very slight; suture one-half around and quite distinct near the apex; color yellowish-white, with a slight red marbling; flesh juicy, creamy white, red at pit; firm and mild; pit large, oval, plump, pointed, cling; quality good; season last of September; glands globose; flowers small; fairly productive.

Pansy.—Trees fairly strong, spreading. Fruit medium to large, roundish; cavity small, deep; suture shallow, more than one-half around; apex slight; color yellow, with a brilliant red cheek and a slight bloom; flesh moderately juicy, yellow to pit, rather coarse, and with a sub-acid flavor; pit very large, plump, free; quality fair to good; season middle of August. A rather shy bearer.

Pearl.—Tree quite vigorous, roundish, with drooping branches. Fruit large, roundish ovate, with one side enlarged; cavity rather broad and deep; apex distinct;

suture well marked for one-half around; color creamy-white, with a bright red blush and a medium amount of bloom; flesh juicy, white, very red at pit, tender, and with a high, pleasant flavor; pit large, oval, pointed, plump, free; quality quite good; season middle of September. Generally quite productive; foliage very slightly crimped; glands globose; flowers small. A handsome and productive variety.

Peninsula.—Tree quite strong, upright, somewhat spreading. Fruit large, roundish, inclining to oval; cavity narrow, deep; apex sunken; suture shallow, more than one-half around; color yellow, washed with red and with a moderate amount of bloom; flesh very juicy, yellow, red at pit, moderately firm and with a sprightly, vinous flavor; pit rather small, plump, pointed, free; flowers small; quality good; season middle of September. Apparently lacking in productiveness.

Pickett.—Tree quite strong, roundish upright. Fruit medium size, roundish, slightly inclined to ovate; cavity narrow, deep; apex a slight elevation in the suture, which is slight and more than one-half around; color yellow, with a red cheek in exposed specimens; flesh juicy, yellow, red at pit, firm and with a mild, sprightly flavor; pit large, plump, oval, cling; quality fair; season last of September; foliage nearly smooth; glands reniform; flowers small.

Pratt.—Tree moderately vigorous, very spreading, with waved and crimped foliage. Fruit medium size, roundish, compressed; cavity very narrow, moderately deep; suture quite distinct; apex small; color yellow, with a red cheek and a considerable amount of bloom; flesh moderately juicy, yellow, red at pit, tender, and with a mild, rich flavor; pit quite large, free; quality good; season last of August. A fairly productive variety.

Prince (Rare-ripe).—Tree quite vigorous, roundish upright. Fruit medium to large, roundish, slightly ovate; cavity broad, shallow; apex quite indistinct; suture slight, more than one-half around; color creamy-white, blushed with red and with a thin bloom; flesh juicy, white, slightly red at pit, tender and with a vinous, mild, pleasant flavor; pit long, oval, pointed, plump, free; quality quite good; season middle of September; foliage crimped, folded; glands globose; flowers small. A fairly productive variety that is valuable for home use.

Princess.—Tree quite strong, roundish, upright. Fruit medium to large, roundish; cavity rather broad, deep; apex slight; suture indistinct; color pale creamy-white, with a slight bloom; flesh very juicy, whitish, faintly marked with red at pit, tender and with a delicate, mild, vinous flavor; pit plump, pointed, free; flowers large; glands globose; quality quite good; season last of September.

Prize.—Tree fairly vigorous, with a round head. Fruit large, roundish; cavity broad; suture slight; apex a mere point; color yellow, more or less blushed and with a thin bloom; flesh very juicy, yellow, red at pit, very tender, with a vinous, sprightly flavor; pit oval, pointed, free; foliage crimped, waved; glands globose; flowers small or medium; quality good; season middle to last of September. The size, color and handsome appearance of the fruit with the productiveness of the tree make it a valuable sort, especially for home use and local market.

Red Cheek.—Tree fairly vigorous, with a roundish upright head. Fruit medium size, roundish, slightly ovate; cavity rather narrow; suture slight and with a swelling on one side; apex prominent; color yellow, with a bright red cheek and a thin bloom; flesh juicy, yellow, red at pit, tender and with a mild vinous flavor; pit rather large, oval, pointed, plump, free; foliage crimped; glands globose; flowers small; quality good; season last of September; moderately productive.

Red Seedling.—Tree fairly vigorous, spreading. Fruit medium size, roundish; cavity broad, rather deep; suture distinct, one-half around; apex distinct; color creamy-white with a bright red blush and a medium amount of bloom; flesh tender, creamy white, moderately firm, and with a mild, vinous, very pleasant flavor; pit small, oval, pointed, nearly free; foliage slightly crimped; glands globose; flowers large; quality good; season middle to last of August.

Reid.—Tree moderately strong, with spreading, slightly drooping branches. Fruit large, roundish ovate, tapering toward apex, which is quite prominent; cavity narrow, deep; suture distinct, more than one-half around; color yellow, with a bright red cheek and a thin bloom; flesh very juicy, yellow, slightly marked with red at pit, tender, vinous, pleasant; pit large, plump, pointed, free; foliage large, crimped; glands globose; flowers small; quality quite good; season last of August. A fairly productive and promising variety.

Reeves.—Tree moderately vigorous, upright. Fruit medium to large, roundish and remotely ovate; cavity broad, deep; apex a slight prominence; suture indistinct; color yellow, with a dark red cheek and thin bloom; flesh juicy, yellow, red at pit; tender with a mild, vinous flavor; pit roundish ovate, pointed, plump, free; foliage crimped; flowers small; glands globose; quality good; season middle of September.

Although a handsome variety the trees have in some seasons shown a lack of productiveness.

Ringold.—Tree moderately strong, roundish upright. Fruit medium to large, roundish, slightly ovate; cavity rather narrow, deep; apex prominent; suture more than one-half around, with the peach enlarged at one side; color creamy white, with a medium amount of bloom; flesh very juicy, white to the pit, very tender and with a rich, sprightly flavor; pit rather large, oval, pointed, cling; foliage crimped, waved; quality good; season early October. A fairly productive variety.

River Bank.—Tree moderately strong, round. Fruit medium to large, round; cavity broad; suture more than one-half around; apex a mere point in the suture; color greenish-yellow, with a dark red cheek, and with a thin bloom; flesh tender, very juicy, greenish or yellowish white, fine grained, mild; pit semi-cling; quality good; season last of July; quite productive.

Rivers.—Tree quite vigorous, spreading, drooping. Fruit large, round oval, slightly compressed; cavity medium size; apex a mere point in the suture, which extends two-thirds around; color creamy-white, occasionally with a slight pink blush and a thin bloom; flesh tender, very juicy, creamy white, fine grained, and with a sprightly pleasant, vinous flavor; pit nearly free; quality good; season early August. Generally hardy and quite productive. A valuable sort for home use.

Roser.—Tree moderately strong, roundish upright. Fruit medium size, roundish, tending to ovate; cavity narrow, deep; apex somewhat prominent; suture indistinct except near the apex; color creamy white with a plentiful bloom; flesh juicy, white to the pit, tender, with a sprightly flavor; pit long, plump, oval, pointed, free; foliage nearly smooth; glands reniform; flowers large; quality rather poor; season early October.

Roseville.—Three quite strong, roundish, drooping. Fruit large to very large, roundish oval; cavity narrow, moderately deep; suture slight, more than one-half around; apex a mere point in the suture; color creamy white with a thin bloom; flesh juicy, creamy white, red at the pit, firm, vinous, rich; pit large, nearly round, very plump, pointed, cling; foliage folded, crimped and waved; glands globose; flowers large; quality good; season last of September. Generally quite productive and one of the most valuable of the late cling varieties.

R. S. Stevens.—Tree moderately strong with dense, round heads. Fruit medium size, roundish, compressed; cavity narrow, moderately deep; suture distinct, more than one-half around; apex a mere point; color yellow with a dark red cheek, and an abundance of bloom; flesh juicy, deep yellow, quite red at the pit, tender, very mild, vinous; pit very small, nearly round, plump; glands reniform; flowers small; quality good; season early September. A hardy and fairly productive variety, but the fruit is rather small for market purposes.

Salway.—Tree quite strong, somewhat spreading, with large, slightly crimped foliage. Fruit large, roundish, slightly oval with one side usually enlarged; cavity medium; suture slight, more than one-half around; apex generally prominent; color yellow, with a red blush in the sun and a medium amount of bloom; flesh moderately juicy, yellow, red at pit, moderately tender and with a pleasant, vinous flavor; pit free; glands reniform; flowers small or medium; quality good; season middle of October. Generally quite productive. The fruit ripens rather late for most sections of the State, but as it can be picked while still quite green and ripened off the trees, it has been found valuable in some sections.

Scott.—Tree moderately strong, roundish upright. Fruit large, roundish, tapering toward the apex; cavity medium size; suture generally indistinct except near apex, which is usually not very prominent; color yellow with a red cheek and thin bloom; flesh juicy, yellow, red at pit, tender, nearly sweet, but not rich; pit roundish oval, plump, free; foliage slightly crimped; glands globose; flowers small; quality quite good; season late September; fairly productive.

Sener.—Tree fairly strong, upright. Fruit quite large, nearly round, but sometimes obscurely ovate; cavity rather narrow, deep; suture very slight, more than one-half around; apex generally prominent; color yellow, blushed and marbled with red and with a moderate amount of bloom; flesh very juicy, yellow, red at pit, quite tender, and of a mild, vinous flavor; pit large, oval, plump, free; foliage slightly crimped, folded; season middle of September. Although the fruit is large and handsome the trees are generally unproductive.

Shipley.—Tree fairly vigorous, roundish upright. Fruit medium to large, roundish, ovate, compressed; cavity large and deep; suture distinct only near the apex, which is usually prominent; color pale yellow, with a red cheek and thin bloom; flesh juicy, yellow, tender, and with a sprightly, vinous flavor; pit free, rather large, oval, plump; foliage crimped and waved; quality fair; season middle of September.

Smock.—Tree fairly vigorous, moderately upright, foliage slightly crimped and waved. Fruit large, roundish, slightly ovate; cavity rather narrow and deep; suture distinct only near the apex, which is a slight elevation; color yellow with a slight blush where exposed and with a dense bloom; flesh moderately juicy, yellow, red at pit, rather tender, mild and sprightly; quality good; season last of September. Generally quite productive.

Sneed.—Tree fairly strong, with rather slender branches. Fruit small to medium, roundish, slightly ovate; cavity narrow and deep; suture distinct, more than one-half around; apex a mere point in a depression; color creamy white, washed and mottled with bright red, and with a very slight bloom; flesh quite juicy, creamy white, tender, mild, vinous and pleasant; pit long, oval, nearly free; quality fair to good; season last of July. A promising early variety.

Snow.—Tree fairly strong with a round head and drooping branches. Fruit medium size, roundish, oval, compressed; cavity medium; suture two-thirds around; apex a slight elevation in the suture; color yellow, with a dull red cheek and slight dapplings of red and a considerable bloom; flesh moderately juicy, yellow, very red at pit, tender, sweet, occasionally with a slight bitter taste; pit large, plump, free; quality fair to good; season early September; fairly productive; foliage crimped; glands obscurely uniform; flowers small.

Southern (Early).—Trees fairly strong, very spreading. Fruit medium size, roundish, compressed at suture; cavity medium size, deep, abrupt; suture well marked, more than one-half around; apex a point in a depression; color yellow, nearly covered with dark red, and with an abundance of bloom; flesh yellow, red at pit, moderately firm, and with a pleasant, rich and sprightly flavor; pit nearly round, very plump, free; quality quite good; season last of August; fairly productive. A handsome yellow variety and one that is fairly promising for its season.

Spottswood.—Tree quite strong, but with spreading head and drooping branches. Fruit medium to large, roundish, inclining to oval; cavity broad; suture slightly marked more than one-half around; apex indistinct; color pale creamy white; flesh very juicy, whitish, red at pit; quite tender and with a vinous, mild, pleasant flavor; pit oval, pointed, plump, free; quality good; season middle of September; flowers large; glands reniform. The trees are quite young, but seem to be early bearers and moderately productive.

Stark Heath.—Trees fairly strong, roundish, upright. Fruit medium size, roundish, slightly oval; cavity narrow, deep; apex very prominent; suture well marked, more than one-half around, and quite distinct near the apex; color creamy white, considerably blushed when fully ripe and with a moderate amount of bloom; flesh fairly juicy, creamy white to the pit; firm and with a mild, sprightly and vinous flavor, but slightly bitter at pit, which is oval, pointed, cling; glands reniform; flowers small; foliage slightly crimped and waved; quality fair; season early October. The trees seem hardy and quite productive, but the trees seem late for this latitude. This variety greatly resembles Health Cling.

Steadley.—Trees quite strong, with a roundish, upright head. Fruit medium size, round, inclining to ovate; cavity narrow, of medium depth; suture slight but extending more than one-half around; apex a mere point; color creamy white, washed with pink, and with a thin bloom; flesh very juicy, white to the pit, tender and of very mild but sprightly flavor; pit rather small, oval, pointed, free; foliage nearly smooth; glands reniform; flowers small; quality quite good; season middle of September; fairly productive.

Stevens Late.—Trees fairly strong, somewhat drooping; foliage nearly smooth. Fruit medium size, roundish; cavity rather narrow, deep; suture slight, often quite indistinct, one-half around; apex slightly elevated; color creamy white, with a bright mottled blush, and a very thin bloom; flesh moderately juicy, pale creamy white, with little red at pit, tender and with a sprightly, vinous flavor; pit roundish, oval, pointed, free; glands reniform; flowers small; quality good; season early October; fairly productive.

Stevens Rareripe.—Trees quite strong, upright, but with drooping branches. Fruit medium to large, roundish ovate; cavity narrow, rather deep; suture slight, more than one-half around; color creamy white, with a dark red cheek, and a medium amount of bloom; flesh very juicy, creamy white, slightly red at pit, tender, vinous and sprightly; pit large, oval, pointed, free; foliage crimped and slightly waved; glands reniform; flowers small; quality very good. Season middle to last of September. The trees are fairly productive, and it is a valuable late variety.

Strong (Mammoth).—Trees quite vigorous with a round head. Fruit medium to large, roundish, remotely ovate; cavity narrow, deep; suture slight, more than one-half around; apex scarcely perceptible; color creamy white, with a slight red cheek, mottled and faintly striped with dark red and with a thin bloom; flesh moderately juicy, white, red at pit, tender, mild, vinous and pleasant; pit oval, pointed, plump, free; quality good. Season middle of September; quite productive.

Stump (The World).—Trees quite strong, roundish upright with drooping branches. Fruit medium to large, roundish, a little oblong ovate; cavity rather wide, deep; suture shallow, rather more than one-half around; apex prominent; color creamy white, with a bright red cheek, and an abundance of bloom; flesh juicy, white, slightly red at pit, moderately firm, high flavored, pleasant; pit oval, plump, free; glands globose; flowers small; quality good. Season middle to last of August.

Summer Snow.—Trees quite strong, roundish, somewhat drooping. Fruit medium size, roundish, compressed towards the suture, which is indistinct one-half around; cavity narrow, deep; apex quite prominent; color white with a thin bloom; flesh juicy, creamy white to the pit, firm rather rich, nearly sweet; pit large, roundish, oval, plump, cling; quality fair; flowers large; glands globose; young wood yellowish green. Season last of September. The trees are badly injured by the leaf-curl and, although the fruit has some merit where white cling peaches are desired for canning, it will not ordinarily be profitable.

Surpasse (Melocoton).—Trees fairly strong, spreading, drooping. Fruit medium to large, round, inclining to ovate; cavity narrow, deep; suture indistinct, one-half around; apex a mere point at the end of the suture; color yellow, with a bright red cheek; flesh juicy, yellow, tender, vinous, sweet, excellent; pit large, plump, nearly round, pointed, free; quality quite good. Season last of August; foliage somewhat crimped; glands reniform; flowers small. The trees thus far have been but moderately productive.

Switzerland.—Trees fairly strong, roundish, upright. Fruit medium to large, roundish, tapering slightly towards the apex; cavity medium size; suture very slight; apex not marked; color creamy white, with a broad, dark red cheek; flesh very juicy, creamy white, tender, mild and vinous; pit medium size, oval, free; quality good. Season middle or last of August; foliage crimped; glands globose; flowers small; fairly productive.

Toledo.—Trees quite vigorous, upright, spreading. Fruit large, roundish; cavity rather large and deep; suture more than one-half around; apex a mere point in the suture; color creamy white, washed, mottled and distinctly striped with red; flesh juicy, creamy white, slightly colored at pit, tender and with a sweet, pleasant but not rich flavor; pit plump, oval, free; quality good. Season middle or last of August. Although the trees are still young they give evidence of being early and abundant bearers, and the size, handsome appearance and high quality of the fruit render it a valuable sort for market.

Toquin.—Trees quite strong with a roundish head. Fruit medium size, roundish; cavity medium; suture slight, one-half around; apex sunken; color yellow, with a dull red cheek, and a thin bloom; flesh moderately juicy, yellow, slightly red at pit, tender, very mild and nearly sweet; pit very small, roundish oval, plump, pointed, free; quality quite good; season middle of September; quite productive. From their behavior thus far the trees appear to be early and profuse bearers. Foliage sligthly crimped; glands reniform; flowers large.

Townsend.—Trees quite strong, with a roundish head. Fruit large, roundish, flattened at base, compressed; cavity broad and deep; suture distinct only near the apex; apex quite prominent; color yellow, more or less blushed and mottled with two shades of red, and with a medium amount of bloom; flesh very juicy, yellow, red at pit, very tender, and with a mild, vinous, pleasant flavor; pit large, plump, oval, pointed, free; foliage crimped; glands globose; flowers small; quality good; season last of September; fairly productive. A large and handsome late variety which bids fair to be of considerable value.

Troth.—Trees fairly vigorous, with a round head. Fruit medium size, roundish; cavity broad, medium; suture generally a line less than one-half around; apex a mere point; color creamy white, with a bright red cheek; flesh juicy, whitish, very red at pit, tender, mild, vinous, but not rich; pit free; glands globose; flowers small, or medium in size; quality fair to good; season last of August; fairly productive.

Tuskena.—Trees fairly vigorous, upright. Fruit very large, roundish to roundish oval; cavity narrow, deep; suture, a line extending past the apex; apex sometimes depressed; color rich yellow with a dark red cheek, and a medium amount of bloom; flesh very juicy, yellow, red at pit; mild, vinous, rich and excellent; fairly firm; pit large, oval, plump, cling; quality quite good; season last of September; flowers small; glands reniform. A large and handsome late cling, which, if productive, may prove of considerable value.

Wales (Princess of).—Trees quite virogous, roundish, with drooping branches. Fruit medium to large, roundish, inclining to oval; cavity medium size; suture hardly perceptible; apex prominent; color creamy white with a thin bloom, frequently with a light blush or marbling of red; flesh juicy, white or greenish white, tender, vinous, sprightly; pit roundish, oval, pointed, plump, free; foliage crimped; glands globose; flowers large; quality quite good; season middle to last of September; quite productive.

Walker (Var).—Trees moderately strong, roundish, upright. Fruit medium to large, roundish oval; cavity medium size; suture slight, but extending one-half around; apex usually somewhat elevated; color creamy white with a bright red cheek and a thin bloom; flesh juicy, pale creamy white, red at pit, tender, vinous and sprightly; pit roundish, oval, pointed, free; foliage slightly crimped; glands globose; flowers small; quality quite good; season last of September.

Washington.—Trees fairly vigorous, upright. Fruit large, roundish, slightly ovate; cavity narrow, rather deep; suture scarcely perceptible; color creamy white with a red cheek and a medium amount of bloom; flesh moderately juicy, whitish, tender, vinous; pit roundish, oval, plump, free; foliage smooth, or very slightly crimped; glands globose; flowers small; quality good; season middle of September; quite productive.

Willett.—Trees fairly vigorous, spreading. Fruit medium size, roundish, slightly ovate, compressed and enlarged at one side of suture, which is slight, extending more than one-half around; cavity medium size, deep, abrupt; apex distinct; color yellow, with a bright red blush and an abundant bloom; flesh moderately juicy, yellow, red at pit, tender, sweet, rather rich, but somewhat bitter near the pit, which is small, oval, pointed, free; flowers large glands reniform; quality fair to good; season last of September; moderately productive.

Williamson (Choice).—Trees moderately strong, upright. Fruit large, roundish, slightly ovate and with a rather narrow, deep cavity; suture slight, more than one-half around; apex a distinct point in the suture; color yellow with a dark blush on exposed specimens and a thin bloom; flesh moderately juicy, yellow, red at pit, fairly tender and with a mild, vinous flavor; pit oval, pointed, free; flowers small; glands globose; foliage crimped; quality good; season middle to last of September; quite productive. A handsome and productive variety that promises to be valuable for market purposes.

Wonderful.—Trees fairly strong, roundish, upright. Fruit large, roundish-oval, with a narrow and deep cavity; suture distinct, more than one-half around; apex a mere point in the suture; color yellow with a red blush when exposed, and a fair amount of bloom; flesh moderately juicy, yellow, red at the pit, rather tender and high flavored; pit large, roundish, oval, free; foliage slightly crimped and waved; glands reniform; flowers small; quality fairly good; season last of September. The fruit is quite handsome, but the trees are lacking in productiveness.

Worthen (Jennie).—Trees fairly strong, spreading. Fruit large, roundish, slightly ovate; cavity deep and narrow; suture distinct, one-half around; apex prominent; color yellow, red where exposed; flesh moderately juicy, yellow, red at pit, tender, delicate, sweet and rich; pit large, oval, plump, free; glands reniform; flowers small; quality quite good; season last of August. A handsome and profitable variety if it proves sufficiently productive.

Yellow Rareripe.—Trees moderately strong, roundish, spreading. Fruit medium to large, ovate, compressed; cavity narrow; suture distinct, extending more than one-half around; apex a mere point; color yellow with a bright red cheek and a medium amount of bloom; flesh juicy, yellow, red at pit, tender and high flavored; pit rather large, plump, free; glands globose; flowers small; quality fair; season early September; moderately productive.

PEARS.

The pear trees were pruned in the early spring, heading back the new growth and thinning out surplus shoots, and, on the 12th of April, the alternate rows of trees were sprayed with copper sulphate solution at the rate of one pound to fifteen gallons of water. On the 23rd of April the remaining rows were sprayed with Bordeaux mixture. This was done for comparison to determine whether there were any increased benefits from the use of Bordeaux mixture as compared with those from the solution of copper sulphate, but no difference could be noticed during the summer. On the 27th of May, after the fruit had set, the trees were sprayed with Bordeaux mixture, containing Paris green at the rate of three ounces in forty gallons. The application was repeated on the 16th of June. As a result of these three applications, the work of the slugs and codling moths was almost entirely prevented and the fruit and foliage were quite free from leaf blight and scab. Although only a comparatively small proportion of the trees bore fruit, all of the specimens were of good size, well colored and quite free from injuries of the insects and fungi.

Descriptions of Varieties.—Angouleme Duchess.—Trees quite vigorous, upright or slightly spreading. Fruit very large, oblong, obovate, surface uneven; cavity broad, shallow, irregular; stalk seven-eighths inch long, stout, fleshy; basin narrow, shallow, irregular; calyx small, closed; calyx tube roundish conical; color greenish yellow, with many large, russet dots; flesh white, juicy, slightly granular, with a rich, mild, vinous flavor and a buttery texture; quality good to very good; season October and November; quite productive. A valuable variety for home use or market purposes. Generally grown as a dwarf.

Anjou.—Trees quite strong and vigorous, upright at first, becoming somewhat spreading as the trees get older. Fruit large, obtuse, pyriform, occasionally varying to conical, generally a little flattened on one side; cavity slight; stalk stout, three-fourths inch long, inclined, fleshy at insertion; basin broad, shallow, calyx small, open, segments reflexed; calyx tube cup-shaped; color greenish or occasionally clear light yellow, sprinkled with russet, and often with a brownish red cheek and many russet patches and dots; flesh whitish, melting, juicy, with a brisk, vinous and perfumed flavor; core medium size, closed, seeds long, oval; quality quite good; season October and November. A shy bearer while young, but if the trees are properly headed back, it proves very productive. One of the best varieties for home use or market.

Ansault.—Trees fairly vigorous, upright. Fruit medium to large, roundish, oblate, pyriform; cavity slight; stalk one-half to one inch long, fleshy at base; basin narrow, rather deep, irregular; calyx closed or nearly so; calyx tube cup-shaped; color yellow, mostly covered with russet and the fruit is generally marked with russet in spots and patches; flesh white, juicy, tender, buttery, melting, aromatic; core closed, seeds oval, plump, numerous; season last of September to first of October; quality fair to good and very productive. An early bearing variety which has some merits as a market variety.

Barry, *P. Barry.*—Trees moderately strong, straggling, spreading. Fruit medium size, elongated, pyriform, slightly obtuse; cavity abrupt; stalk one inch long, medium size, inclined; basin narrow, shallow, regular; calyx small, open, segments short; calyx tube cup-shaped; flavor sweet, vinous, rich; flesh whitish, rather juicy, melting, texture firm, fine-grained, quality fair; season December to April; quite productive. An awkward, straggling growing tree, but it seems to be quite productive, and the fruit apparently has a value for market purposes.

Bartlett.—Trees quite vigorous, upright. Fruit large, oblong, obtuse, pyriform; cavity slight, three-fourths to one and one-half inches long, stout; basin shallow, irregular; calyx open, segments short; calyx tube cup-shaped; color yellow, with numerous specks and patches of grayish russet, sometimes with a light red cheek; young wood often yellowish brown; flesh white, juicy, fine-grained, buttery, tender, with a musky aroma that is unpleasant to some persons; quality good; season early September; generally quite productive.

Bloodgood.—Trees quite strong, nearly upright. Fruit small to medium, turbinate, inclining to obovate; cavity very small; stalk one inch long, fleshy at insertion, inclined; basin shallow; calyx open, medium, segments short; color yellow, sprinkled with russet dots and a net-work of markings, giving it a rusty look on one side; flesh creamy white, buttery, melting, sweet, perfumed; quality good; season middle of August. A valuable sort for dessert purposes. Growth rather short-jointed, with deep, reddish-brown wood.

Bosc.—Trees fairly vigorous, rather upright. Fruit large to very large, pyriform, a little uneven, generally with long neck, which tapers gradually into the stalk; cavity none; stalk one and one-half to two inches long, rather slender, curved; basin shallow, even; calyx rather large, open, with short, erect segments; calyx tube cup-shaped; color dark yellow, nearly covered with patches and dots of cinnamon russet; skin rather smooth, slightly marked with red in the sun; flesh white, melting, very buttery, rich, delicious, and slightly perfumed; quality very good; season early October; generally quite productive, but as the trees make a poor growth in the nursery, it is desirable to have this variety top-worked. Valuable both for home use and market purposes.

Boussock.—Trees quite strong, upright or slightly spreading. Fruit large, roundish, obovate, with a small, round cavity, and a stalk varying from one-half to one and one-half inches in length, stout; basin shallow, slightly ribbed; calyx large, open; calyx tube cup-shaped; flesh creamy white, juicy, buttery, melting, with a sweet, aromatic flavor; season September; quality fair to good; generally quite productive, and a valuable variety for local markets.

TABULATION OF PEARS—*Pyrus Communis*—1898.

Abbreviations—Season, months—b, beginning; e, end; m, middle. Form—e, elongated; i, irregular; o, oblate; ob, oblong; obo, obovate; obt, obtuse; ov ovate; p, pyriform; r, round; t, turbinate. Color—b, brown; c, crimson; g, greenish; r, red; ru, russet; w, whitish; y, yellow. Texture—b, buttery; f, firm; g, granular; m, melting; t, tender; b, breaking. Flavor—a, acid; m, mild; as, astringent; j, juicy; s, sweet; v, vinous; p, perfumed. Use—d, dessert; k, kitchen; m, market.

Number.	Names.	Planted.	Bloomed.	Season.	Vigor.—Scale 1-10.	Origin.	Product.—Scale 9-10.	Weight in ounces.	Form.	Color. Skin.	Color. Flesh.	Texture.	Flavor.	Quality.—Scale 1 to 10.	Use.
1	Angouleme	1891	May 8	Oct. Nov.	9 10	France	10	17.5	ob obo	g y ru	w	b	m v	6 7	m
2	Anjou	1888	" 9	Oct.	10	France	3 4	10	obt p	g y r r	w	m	v p	8 9	d m
3	Ansault	1889	" 10	e Sept. Oct.	8	France	10	6.5	obo obt p	y w	w	t b m	p	6	m
4	Barry (P.)	1892	" 15	Dec. Apr.	7 8	California	2	8	e p obt	y ru	w	f	s v	5 4	d m
5	Bartlett	1891	" 9	m Sept.	8 9	England	4	7	obo obt p	y ru	w	t b	v p	6	d m
6	Bloodgood	1888	" 9	m Aug.	10	New York	8 9	3.5	t obo	y ru	y w	b m	s p	5 6	d
7	Bosc	1888	" 11	e Sept. Oct	10	Belgium	5	10	p i	y r ru	w	m b	p j	10	d m
8	Boussock	1891	" 9	Sept. Oct.	10	Belgium	4 5	6.5	r obo p	y ru	w	b m	s j p	5 6	m
9	Buffum	1891	" 10	Oct. Nov.	10	Rhode Island	5	5.5	ob obo	y r ru	w	t b g	m	7 8	m
10	Clapp Favorite	1888	" 12	b m Sept.	10	Massachusetts	10	9.5	t	y b ru	w	b m	v	6 7	d m
11	Comice	1891	" 10	m e Oct.	7 8	France	10	6.5	r obt	g b r	w	b m	j s p	9	d m
12	Dana Hovey	1888	" 10	Oct. Jan	10	Massachusetts	10	4	obo obt p	r ru	y w	g m	s p	10	d
13	Dearborn	1891	" 10	Aug.	9 10	Massachusetts	10	4.5	r p	y ru	w	m	s j	8 9	d
14	Desportes	1891	" 11	Aug.	9 10	France	9	4	p	g r ru	w	m b	m	5?	m
15	Drouard	1891	" 13	Oct. m Nov.	9 10	France ?	4	13	r obo obt i	y ru	w	t b	s p	4 5	m
16	Duhamel	1891	" 11	m Oct.	7 8	France	1	4	obt obo p	y ru	w	m g	v s	7 8	d ?
17	Early Duchess	1892	" 11	m Oct.	7 8	France	4 5	8	obo obt p	y r ru	w	t b m	v j	6 7	m
18	Edmonds	1889	" 13	Sept. Oct.	10	New York	2 3	7	obo obt p	g y	w	m	s	5 6	m
19	Elizabeth (Manning)	1891	" 9	e Aug.	10	Belgium	9 10	3	r obo	y r	w	m	s p	8 9	d
20	Esperen	1891	" 9	Oct. m Nov.	9 10	Belgium	3 4	4	r obt p	g ru	w	g m	v j	4 5?	m
21	Fitzwater	1891	" 11	Oct.	7 8	New York	5	7	obo obt p	y ru	w	b m	s	8 9	d
22	Flemish	1891	" 9	m Sept.	10	Belgium	8 9	10	o obt p	y ru r	w	m	s j	6 7	m
23	Fred Clapp	1888	" 11	Sept. Oct.	10	Massachusetts	9 10	11	r obo p i	y ru	w	b m	v	7 8	d m
24	Giffard	1888	" 9	Aug.	9	France	8	4	p	g y r	w	m	j v p	9 10	d
25	Gray Doyenne	1888	" 9	Sep. m Nov.	9	France	4	5	ov obo p	ru	y w	b m	rich	8 10	d
26	Groveland	1890	" 9	m Nov.	9	Alabama ?	5	9	obo obt p	y ru	w	t m b	s p	8 9	d m
27	Howell	1888	" 9	Sept. Oct.	8 9	Connecticut	5 6	7.5	r p	y r ru	w	m	v	5 6	m
28	Jones	1889	" 1	Oct. Nov.	8	Pennsylvania	3 4	4	obo p	y ru	w	g b	s v	5 6	d
29	Keiffer	1891	" 9	Oct. m Nov.	9	Pennsylvania	8 9	6	r ov ob obt p	y r ru		g m	s p v	3 4	m
30	Kentucky	1891	" 10	Sept.	10	Kentucky ?	3 4	4	t obo	y ru		m g	m	3 4	m ?

31	**Kraus 41**	1895	May 12	Sept.	9	New York	few	3.75	p	y	w	t b	s	3 4	?
32	Lawrence	1888	" 9	m Oct. Dec.	8	New York	5 6	6	obo obt p	y ru	w	m	s p	8 9	d m
33	Lawson	1889	" 10	m Aug.	9 10	New York	1 2	6.5	obo p	y r	w	g b	s	3 4	m
34	Longworth	1891	" 9	Sept.	10	Ohio	1	7	r	y ru	w	----	----	----	----
35	Lucrative	1888	" 11	m Sept.	9	Europe	6 7	7	obo p	y	w	m	s	8 9	d m
36	Margaret	1889	" 10	Aug.	9	Ohio	10	5	obo	y g	w	t b	v	8	d
37	Marguerite *Petite*	1889	" 10	Aug.	9	France	10	1.75	obt p	g y ru	w	b m	s j p	5 6	d
38	Millett	1891	" 10	Dec. May	8	Europe	4 5	7	r obo obt i p	g y ru	w	f b	v	5 6	k
39	Mount Vernon	1888	" 9	Oct. Nov.	9	Massachusetts	10	6	r ov obt p	y ru	w	t b m	j v p	7 8	k m
40	Ogereau	1891	" 9	Oct. Nov.	8 9	Europe ?	9	9	obo ob p	y r ru	w	b	v	6 7	m
41	Onondaga	1891	" 10	Sept. Nov.	10	New York	6	10	ov obo o p	y ru	w	b m	v p	7	m
42	Pitmaston	1891	" 10	Oct. Nov.	8 9	England	5 6	17	ob obo p	y ru	v w	m b	v	7 8	m
43	Reeder	1890	" 9	Oct. b Nov.	8	New York	8 9	10	r ov obt p	y ru	w	b m	v	7 8	d m
44	Rostiezer	1888	" 10	m Aug. m S.	8	Europe	8	3	obo p	y b ru	w	m b	s v p	10	d
45	Rutter	1892	" 9	m e Oct.	9 10	Pennsylvania	9 10	10.5	r p	y g ru	w	b m	s v	7	m
46	Seckel	1888	" 10	Oct.	9 10	Pennsylvania	6 7	3	obo	y b r	w	b m	s v	10	d
47	Sheldon	1890	" 11	Oct.	10	New York	6	5.5	r obt obo	y b ru	w	m	s v p	7 8	m d
48	Sterling	1888	" 9	Aug. b Sept.	10	New York	5	4.5	r t	y ru r	w	m	s	5 6	m
49	Summer Doyenne	1888	" 9	e Sept.	10	Belgium	5	1.5	r obo	y b	w	t b m	s v p	5	d
50	Victor	1891	" 11	Oct.	10		1	9	obt p	y	w	t m b	s p	7 8	d m ?
51	Winter Nelis	1888	" 13	Oct. m Jan	9 10	Belgium	8 9	6	obo p	y ru	w	t b m	s p	10	d m
52	Zache	1894	" 13	e Oct. Dec. ?	10		few	11	r o	y	w	g	s	2 3	?

Buffum.—Trees strong growing, very upright. Fruit medium to large, oblong, obovate, with one side larger than the other; cavity very slight; stalk stout, three-fourths to one inch long; basin of medium size and depth, plaited; calyx small, open, segments partially reflexed; calyx tube cup-shaped; color a greenish yellow, sprinkled with small, brown dots, and more or less marked with bright red and russet: flesh creamy white, moderately juicy, tender, buttery, granular, sweet, excellent; quality fair to good; season October to November. An early bearing, productive variety.

Clapp *Favorite.*—Trees very vigorous, upright. Fruit large, tùrbinate; basin broad, plaited; cavity none; stalk one to one and one-half inches long; quite stout, fleshy at insertion; calyx irregular, open; calyx tube funnel-shaped; color yellow, with brownish-red cheek, surface overspread with many brownish-red dots; flesh white, juicy, when fully ripe buttery, melting, and with a vinous, sprightly, rich flavor; seeds few, long, ovate pointed; season early September; quality fair to good; young wood stout, dark brown. As a rule a productive sort, but the trees are subject to the attack of pear blight, and the fruit is inclined to rot at the core when ripe.

Comice.—Trees large, upright. Fruit large, roundish, pyriform, or broad, obtuse, pyriform; cavity shallow, often russeted; stalk short, stout, inclined; basin large, deep, uneven; calyx small, open; color greenish-yellow, becoming clear yellow at maturity, often lightly shaded with crimson and fawn in the sun, and with light nettings and patches of russet and numerous russet dots; flesh white, juicy, melting, a little buttery, with a fine texture, and sweet, rich, sprightly and aromatic flavor; quality good; season October to November; quite productive.

Dana's Hovey.—Trees quite strong with upright growth; young wood brownish-green. Fruit medium size obovate, obtuse, pyriform; cavity slight, sometimes upon an irregular protuberance; stalk one-half to one inch long, moderately stout, curved, basin narrow, rather deep, often irregular; calyx rather large, open; color yellow, russeted, flesh very juicy, yellowish-white, slightly granular, half melting, with a sweet, perfumed and rich flavor; quality very good to best; season October to January. One of the best winter varities for dessert purposes, owing to its productiveness and high quality, which rivals the Seckel.

Desportes.—Trees quite vigorous, very upright. Fruit medium size, pyriform, tapering towards the stem; basin open, slightly ribbed and russeted; calyx partially closed, stout; cavity uneven; stalk three-fourths to one inch long, very stout, inclined; color green, slightly blotched and speckled with russet, with a pale red cheek where exposed; flesh creamy white, melting, buttery, sub-acid, not rich; season August; quality fair; quite productive.

Drouard.—Trees quite strong, of an upright and slightly spreading form. Fruit quite large, roundish, obovate, obtuse, somewhat irregular; cavity deep, small, irregular; stalk three-fourths inch long, rather stout; basin medium, shallow, slightly irregular; calyx small, partially closed; color yellow, considerably washed, netted and specked with russet; flesh creamy white, tender, buttery, and with a sweet, perfumed flavor; qaulity good; season October and November. The young trees as yet have been but moderately productive, but if they prove to be free bearers, it will probably be a valuable market variety.

Duhamel (du Monceau).—Trees quite vigorous with an upright growth. Fruit medium size, obovate, obtuse, pyriform; cavity very slight; stalk one and one-fourth inches long, stout, fleshy at insertion, generally inclined; basin rather narrow, shallow, sometimes slightly corrugated; calyx open or half closed; color yellow, with many russet specks and patches of gray or cinnamon russet; quality quite good; season October and early November; fairly productive.

Early Duchess (Duchess Precoce).—Trees fairly vigorous, upright. Fruit large, obovate, obtuse, pyriform; cavity narrow, shallow; stalk one inch long, medium, oiften inclined, fleshy at insertion and occasionally lipped; basin shallow, abrupt, regular, slightly ribbed; calyx small, open, segments erect; color yellow, frequently with a flushed cheek, and with numerous russet specks and with blotches, spots and tracings of light cinnamon russet; flesh whitish, very juicy; core compact; texture tender, fine grained, buttery, melting; flavor vinous, sprigntly, with a peculiar aroma; season October; quality quite good; fairly productive.

Edmonds.—Trees quite vigorous, upright or slightly spreading. Fruit of medium size, obovate, obtuse, pyriform; cavity none; stalk stout, curved, two inches long; basin broad, shallow, corrugated; calyx large, segments crumpled, open; color pale greenish-yellow; flesh fine grained, whitish, juicy; flavor sweet, juicy, peculiar; texture half melting; quality good; season September and October. As yet somewhat lacking in productiveness.

Elizabeth (Manning).—Trees quite strong, roundish, conical. Fruit medium size, roundish, obovate; cavity very slight, lipped; stalk one-half to one inch long, generally inclined; basin broad, shallow, regular, slightly corrugated; calyx rather large, open; color pale yellow, with a bright red cheek and sometimes flecked with brownish russet and numerous dark spots; flesh white, juicy, fine grained, buttery; flavor sweet, perfumed; quality quite good; quite productive; season last of August; young wood dark brown.

Esperen.—Trees strong, upright, spreading. Fruit medium to large, roundish, obtuse, pyriform; cavity shallow, slightly plaited; stalk one and one-fourth to one and one-half inches long, inclined; basin deep, acute; calyx medium, open, segments upright; color light green, mostly covered with cinnamon russet in specks and patches, and with many russet dots; flesh creamy white, juicy, tender, granular, melting, and with a highly vinous flavor; quality good; season October and November; quite productive.

Fitzwater.—Trees of fair growth, upright. Fruit medium to large, obovate, obtuse, pyriform; cavity very slight or none; stalk one-fourth to three-fourths inch long, stout, inclined, fleshy at insertion; basin narrow, shallow, slightly abrupt; calyx small, open; color yellow, with numerous spots, tracings and blotches of cinnamon russet, especially about the apex; flesh white, very juicy, fine grained, buttery, melting; flavor sweet, sprightly and with a pleasant aroma; quality good; season October; quite productive. A promising variety for dessert or market purposes. Young wood yellowish-brown, foliage rather small, petiole short, leaf slightly cupped and waved.

Flemish (Beauty).—Tree quite vigorous, with an upright head. Fruit quite large, obovate, obtuse, pyriform; cavity narrow, round; stalk one to one and one-half inches in length, stout, slightly inclined; basin small, round; calyx short, open; color pale yellow, mostly covered with marblings and patches of russet and often becoming reddish-brown at maturity on the sunny side; flesh white, juicy, rather fine-grained, melting, very saccharine and rich, with a slight musky flavor; quality good; season middle of September. A desirable variety for market or home use, except that it is subject to blight and when unsprayed it is seriously injured by pear scab and leaf blight.

Frederick Clapp.—Tree quite strong, with an upright head and drooping branches. Fruit quite large, roundish, inclining to obovate, sometimes irregular; cavity small, shallow, irregular, stalk one inch long, stout, inclined; basin medium, regular; calyx small, open, segments erect; color clear yellow, with a few brown patches; flesh whitish yellow, very juicy, fine grained, buttery, melting, and with a highly vinous and rich flavor; quality quite good; season the last of September and October. The trees seem to be very productive and it is apparently a very valuable variety either for home use or market.

Gakovsk.—Trees upright with spreading, slender shoots. Fruit small to medium, pyriform; cavity very slight with a fleshy ring about the stalk which is one and one-fourth to one and one-half inches long; basin very shallow, grayish; calyx large, open,with upright segments; color greenish-yellow, with indistinct dots; flesh dingy white, fine grained, buttery, nearly seedless; core small, nearly closed; flavor mild, vinous, but not rich; season early August. Shoots olive colored; foliage rather narrow, slightly folded and recurved; quality rather poor. It seems to have little to commend it when we have other varieties at the same season that excel it in every respect.

Giffard.—Trees moderately strong, upright, with slender branches. Fruit medium to large, long, pyriform; cavity none; stalk one-half inch long, stout, inclined, fleshy at insertion; basin narrow, smooth, shallow; calyx medium open; segments long, upright; color greenish yellow, with a dull red cheek, thickly sprinkled with red dots; skin quite smooth; flesh white, tender, juicy, melting, and with a vinous, perfumed flavor; core very small, compact; seeds few, long, oval, pointed; quality quite good; season first to the middle of August. One of the best pears of its season.

Groveland.—Trees fairly vigorous. Fruit large, obovate, obtuse, pyriform; cavity medium, abrupt, regular; stalk one-half to three-fourths inch long, very stout, inclined; basin narrow, shallow, regular; calyx small, open, segments recurved; color greenish-yellow, with a brownish cheek and with most of the surface washed, netted and specked with russet; flesh creamy white, juicy, tender, melting, buttery, and with a sweet perfumed and slightly vinous flavor; core small, open; seeds few, oval, pointed; quality good; season middle of October and November. The trees were received from Alabama and if they prove productive, it is likely to become a valuable variety.

Howell.—Trees fairly vigorous, upright. Fruit large, roundish, pyriform; cavity usually none; stalk three-fourths to one and one-eighth inches long, sometimes lipped; basin rather large, shallow, uneven; calyx open, segments recurved; color light yellow, frequetly with a blush in the sun and with the surface thickly sprinkled with russet dots and some russet patches; flesh whitish, very juicy, melting, brisk and vinous; core closed, seeds few; quality good; season last of September. A valuable variety either for home use or market.

Jones.—Trees quite strong and upright with the young shoots of a dull olive brown. Fruit medium size, obovate, pyriform; cavity none; stalk medium size, one and one-fourth inches long, inclined, fleshy at insertion; basin broad, shallow, uneven; calyx open; color yellow, shaded with russet and bright crimson in the sun; flesh white, rather coarse, granular, buttery, sugary and with a brisk, vinous flavor; quality fair to good; season October. Only moderately productive.

Keiffer.—Trees very vigorous, upright, with large, dark green glossy foliage. Fruit large, roundish oval, narrowing at both ends, usually with largest diameter near the center, although in some specimens the form is roundish, inclining to oblong, obtuse, pyriform; stalk one-half to three-fourths inch long, moderately stout, set in a medium cavity; basin medium, a little uneven; calyx open, segments nearly erect; color deep yellow, orange in the sun, and with a red cheek and a few patches, nettings, dots and specks of russet; flesh whitish, juicy, and when properly grown and ripened, half melting, although it is inclined to be a little coarse, granular and crisp; flavor sweet, somewhat spicy and vinous; core slightly open, medium; seeds plump, oval; quality fair in sections where the season allows them to develop and when they are ripened in the house; season October and November. The trees are early and productive bearers, but in some sections are much troubled with pear blight.

Kentucky.—Trees very strong and spreading. Fruit medium size, short turbinate, inclined to obovate; cavity small, uneven; stalk one inch long, slender, inclined; basin narrow and deep; calyx large, open, segments upright; color clear yellow, with slight nettings of russet and many brown dots and specks; flesh creamy white, somewhat lacking in juice, rather coarse and granular, and with a slight, rather mild flavor; quality rather poor; season middle of September. This variety seems to have little to recommend it.

Kraus 41.—Trees fairly vigorous, with an upright head and slightly spreading branches. Fruit medium size, regular, pyriform; stalk one and one-half inches long, much inclined at insertion by a lip in a small cavity; basin broad, medium, plaited; calyx medium size, closed, segments moderately long, reflexed; color yellow, with numerous green and brown specks; flesh white, somewhat lacking in juice, tender, bettery, sweet; core closed; quality rather poor; season last of August.

Lawrence.—Trees fairly strong, somewhat spreading; young wood dull yellowish-brown. Fruit medium to large, obovate, obtuse, pyriform; stalk stout, one to one and one-half inches long in a narrow, irregular russeted cavity; calyx small, partially open, with short, persistent segments in a broad, shallow uneven basin; color yellow, with traces and occasional patches of russet and numerous brown dots; flesh whitish, juicy, melting, with a sweet and aromatic flavor; quality quite good; season October to December. The trees are usually quite productive and it is generally considered one of the most valuable early winter varities.

Lawson.—Trees quite strong, upright. Fruit medium to large, obovate, inclined to pyriform; stalk three-fourths inch long, stout, fleshy, inclined, in a very slight cavity; calyx large, open, segments reflexed, short, in a broad, shallow, slightly corrugated basin; flesh whitish, rather dry, coarse and breaking; flavor sweet; color yellowish orange, striped with pinkish red and marked with a few dark specks; core small compact; seeds roundish oval; quality rather poor; season middle of August. A handsome variety but of little value otherwise.

Lucrative.—Trees rather strong, upright. Fruit large, varying from obovate to long pyriform; stalks and one one-fourth inches long, stout, often fleshy at insertion and somewhat inclined; cavity none; calyx large, open, in a broad shallow basin; color greenish-yellow at maturity; flesh whitish, juicy, melting, with a sugary, rich and delivious flavor; quality quite good; season last of September; core closed; seeds few, long, ovate, pointed; young wood yellowish-brown. The variety is generally productive and is an excellent sort for home use.

Margaret.—Tree quite strong, upright. Fruit medium to large, obovate, conical; stalk medium size, one and one-half inches long, inclined, in a narrow, deep cavity; calyx irregular, in a broad, shallow plaited basin; segements partially reflexed; color yellowish-green with many large, greenish dots; surface sightly uneven; flesh white, juicy, tender, buttery, with a vinous, sprightly flavor; core small, closed; seeds few;

quality good; season middle to last of August. A productive variety of high quality, which is valuable for home use.

Marquerite (Petite).—Tree fairly vigorous and very upright. Fruit quite small, obtuse, pyriform; stalk one and one-half to two inches long, stout, inserted with a ring; cavity none; calyx open, segments fleshy, generally upright, in a broad, very shallow and slightly irregular basin; color greenish-yellow, with a brownish-red cheek, and with numerous red dots; flesh white, moderately juicy, crisp, breaking, sweet and perfumed; seeds few; quality good; season middle of August. A handsome pear of good quality, but its size is rather small.

Millett.—Tree rather strong, quite upright. Fruit large, roundish, ovate, obtuse, pyriform, often irregular; stalk one inch long, rather stout, inclined, in a cavity of moderate size, generally irregular; calyx large, open, in a regular rather deep basin; color greenish yellow, with much russet in blotches and irregular dots and specks; flesh white, firm, breaking, highly vinous; quality good; rather late for this section, as the fruit failed to ripen, but it seems to have good keeping qualities, as specimens were sound and in good condition the first of the following June.

Ogereau.—Trees quite strong, very upright. Fruit large to very large, varying from obovate to pyriform, sometimes oblong obovate pyriform; stalk one-half to one inch long, stout, fleshy at insertion, generally in a shallow cavity; calyx open, of medium size, in a broad, shallow, plaited basin; color yellow, nearly covered with cinnamon russet and with a faint blush when exposed; flesh white, juicy, crisp and breaking, with a mild, vinous, pleasant flavor; core closed, seeds few; quality good; season middle of October and November. Young wood yellowish olive and generally stout. The variety seems to be an early and profuse bearer and valuable either for home use or market purposes.

Onondaga.—Tree very vigorous, with an upright head but with spreading branches. Fruit quite large, obovate and sometimes oblate pyriform; stalk one inch long, stout, inclined and often curved, and inserted with a lip in a slight cavity; calyx closed, in a narrow shallow, plaited basin; color rich yellow at maturity with roundish russet dots; flesh whitish, very juicy, slightly granular, buttery and melting, with a rich, vinous, aromatic flavor; quality good. Season last of September to November. Young wood olive brown. Generally quite productive and a valuable market variety.

Pitmaston (Duchess).—Trees quite vigorous, upright, spreading. Fruit very large, oblong, obovate, remotely pyriform; stalk three-fourths inch long, moderately stout in a small uneven cavity; calyx small, closed, with upright segments; color yellow, with light russet near the stalk and with many russet dots and specks over the whole surface, which is often somewhat irregular; flesh yellowish, juicy, melting, buttery and with a very sprightly, vinous flavor; quality good; season middle of October and November; seeds few, abortive. A promising market and culinary variety, differing but slightly from Angouleme.

Reder.—Trees quite strong, upright. Fruit large, roundish ovate, obtuse pyriform; stalk one and one-half inches long, moderately stout and fleshy at insertion; cavity none; calyx large, open, segments reflexed in a broad, shallow, regular basin; color clear light yellow, with numerous russet dots and occasional patches of russet, especially near the calyx, and with a faint reddish cheek; flesh white, juicy, buttery, melting, with a rich and vinous flavor; quality quite good. Season middle of October and November.

Rutter.—Trees vigorous, upright. Fruit quite large, roundish pyriform; stalk one inch long, stout, inclined, curved, in a narrow, abrupt cavity; calyx small, nearly or quite closed, segments narrow, nearly erect in a shallow, broad, uneven basin; color yellow, sprinkled and netted with russet and with minute greenish, irregular specks; flesh white, moderately juicy, half fine-grained, buttery, nearly melting, with a sweet vinous flavor; quality good. Season early October; young wood yellowish-brown. The trees seem quite productive, and the size and quality of the fruit make it desirable either for market or home use.

Seckel.—Trees fairly strong, conical, healthy, hardy. Fruit small to medium, obovate, sometimes slightly pyriform; stalk one-fourth to one inch in length, stout, slightly curved; cavity none; calyx open, segments erect, in a narrow, very shallow basin; color dull yellowish-brown, often covered with smooth cinnamon russet, and generally with a dark brownish red cheek; flesh white, juicy, tender, melting, buttery, with a rich, sweet, vinous flavor; quality very good. Season October. Young wood olive brown. The trees are generally productive and when the fruit is well grown, even though at best it is of but medium size, its handsome appearance and high flavor make it one of the best dessert pears.

Sheldon.—Trees quite vigorous, erect and hardy, with large, thick, glossy leaves. Fruit large, roundish obtuse, obovate; stalk three-fourths inch long, in a rather deep cavity; calyx open, segments partly recurved, in a large, broad basin; color greenish yellow, mostly covered with thin light russet, and a little brownish-crimson in the sun, and with many russet dots; skin rather thick, harsh; flesh whitish, very juicy, melting, with a sweet, vinous, rich and aromatic flavor; quality quite good. Season middle to last of October. Young wood yellowish brown. Trees generally productive and although not especially desirable for market purposes, it is one of the best kinds for home use.

Souvenir (du Congres).—Trees fairly vigorous, generally spreading. Fruit large to very large, obovate, obtuse, pyriform; stalk three-fourths inch long, very stout, much inclined; cavity none; calyx open, with reflexed segments, in a shallow, medium sized basin; color a handsome yellow at maturity, washed with bright red or carmine in the sun and brownish dots, russeted at the stem; flesh white, rather course, slightly perfumed, vinous; quality good. Season last of September and early October.

Sterling.—Trees vigorous, upright. Fruit medium to large, nearly round, slightly turbinate; stalk one to one and one-fourth inches long, inclined, curved; cavity small or none, sometimes lipped; calyx open, in a broad, shallow basin; color yellow, netted with brownish russet and with a brilliant crimson cheek; flesh white, juicy, fine grained, crisp and melting, with a sweet flavor; core closed, medium; quality good. Season last of August and first of September; twigs light yellowish brown. A valuable market variety.

Victor.—Trees upright. Fruit quite large, obtuse pyriform; stalk one and one-fourths inches long, slender; cavity none; calyx very small, closed, in a moderately deep, slightly irregular basin; color clear, light yelow, with many greenish specks; flesh creamy white, granular, tender, melting, buttery, with a sweet, highly aromatic flavor; quality quite good. Season middle to last of October. If sufficiently productive, it is likely to prove a valuable variety, either for dessert or market purposes.

Winter Nelis.—Trees fairly strong, but very irregular and straggling in growth. Fruit medium size, varying from obovate to pyriform; stalk moderately stout, one and one-fourth inches long, in a small, narrow cavity; calyx open, segments nearly upright, in a broad, moderately deep basin; color yellow, more or less covered with blotches and spots of dark cinnamon russet; core closed, seeds few, long, ovate, pointed; flesh white, juicy, tender, melting, buttery; of a rich, sweet, aromatic flavor; quality very good. Season October to January. Young wood moderately stout, dark reddish brown.

Zache.—Trees very vigorous, quite upright. Fruit large, roundish oblate; stalk one and one-fourth inches long, stout, slightly inclined, in a narrow, deep, regular cavity; basin wide, very deep, varying to narrow and shallow in some specimens; calyx lobes generally dropped; color orange at maturity, with a pinkish tinge, and with many light yellowish dots and specks; surface generally roughened; flesh rather dry, coarse, crisp and granular, with a sweet, slight pine-apple flavor; quality very poor. Season November to December. Foliage very large, glossy. In young trees the branches are very large and with numerous yellow spots on the olive-green bark. The coarseness and poor quality of the fruit render it of no value, although the trees are early and profuse bearers.

PLUMS.

After the plums were pruned in the early spring, they were given the same application of fungicides as the pears, and although this treatment usually suffices to save the crop from the plum curculio when a large number of fruits set, the comparatively light setting of some varieties made jarring desirable. This was done at intervals from the 1st to the 15th of June, and while the curculio seemed quite numerous at first, the number found later on was very small. Considerabel trouble was experienced from the work of the aphis upon the foliage, but a thorough spraying with kerosene emulsion proved effectual in destroying them. On the the 12th of August, when the weather was extremely dry, the foliage of some of the trees that were bearing heavy crops of fruit began to wilt and from one to two barrels of water were placed in a basin about each tree. As soon as the water had soaked away, the soil was replaced and on the following morning the foliage and fruit were found to have resumed their former plumpness, and the plums developed to their full size at the proper time.

European Plums.

Agen Prune.—Tree quite vigorous and of a dense, roundish, upright form. Fruit oval; stalk one inch long, slender; cavity very slight and narrow; apex scarcely perceptible; suture indistinct; color dark purple, nearly black, with a medium, bluish bloom; flesh juicy, pale green, very firm and tender with a mild, vinous flavor; pit small, oval, flattened, free. It has shown itself thus far, somewhat lacking in productiveness. Ripe August 9; weight two-thirds of an ounce. Young wood is smooth, dark-brown in color.

Arch Duke.—Tree quite vigorous, upright. Fruit roundish, slightly oval; stalk one-half inch long, slender; cavity imperceptible; apex indistinct; suture broad, shallow, more than one-half around; color black, with a dense light blue bloom; flesh juicy, pale amber, tender, rather acid; pit rather small, oval, pointed, flat, free; quality medium; size large. Young wood reddish brown.

Arctic.—Tree rather vigorous, with an upright, round head, and with branches somewhat spreading. Fruit roundish, oval; stalk three-fourths inch long, slender; cavity very slight; apex hardly noticeable; suture indistinct; color black, with a thin, blue bloom; flesh tender, juicy, yellowish amber, very firm, nearly sweet; pit small, oval, nearly free. Season August 16; size medium. A hardy and generally productive variety, but the fruit is much too small for market purposes.

Aubert *Yellow.*—Tree quite vigorous, upright. Fruit oval to ovate; stalk stout, one inch long, inserted within a fleshy ring; cavity narrow, slight; apex indistinct; suture not very distinct; color rich clear yellow, with a slight whitish bloom; flesh juicy, yellow, quite firm, but tender, rich and sweet; pit long, oval, pointed, cling; quality good. Generally quite productive. Season August 30, fruit large. One of the most promising of the yellow varieties.

Bavay.—Tree rather vigorous, upright, but with its branches slightly spreading. Fruit roundish; stalk three-fourths of an inch long, medium size; cavity broad, shallow; apex unmarked; suture very slight; color dull greenish-yellow, with a thin, whitish bloom; flesh very juicy, of a pale, dull yellow, quite firm, sweet, rich, delicate; pit oval, cling; quality very good. Season September 29. Fruit medium to large. This variety is often sold under the name of Green Gage, which is of smaller size and ripens several weeks earlier. The fruit of Bavay nearly equals that of the true Reine Claude, and is superior to that variety in the vigor and productiveness of the trees.

Bradshaw.—Tree quite vigorous, upright, slightly spreading. Fruit oval or obovate; stalk one inch long, rather stout, curved; cavity small; apex slightly sunken; suture one-half around, broad, shallow; color reddish purple; bloom light blue; flesh juicy, yellowish, coarse, brisk, pleasant; pit semi-cling; ripe August 20; size large; quality good. Generally quite productive, and a valuable early variety. As a market sort, its principal fault is that it is subject to the attack of the brown rot.

Coe, Golden Drop.—Tree rather vigorous, roundish, upright. Fruit oval and with a slight neck, and with one side often enlarged; stalk three-fourths to one inch long, slender; cavity none, but with a close ring; apex pointed, in a shallow suture; suture more than one-half around; color yellow, with a light, white bloom; flesh light amber, or greenish-white, rather firm and with a sprightly, vinous, rich flavor; pit small, oval, pointed, plump, cling; quality good. Ripe September 23; fruit large; young wood purple. Although in some sections it is found productive, its principal fault seems to be a lack of productiveness.

Columbia.—Tree rather strong, with an upright habit, and slightly spreading branches. Fruit nearly globular, with one side larger than the other; stalk three-fourths to one inch long, medium; cavity narrow, small; apex in a depression; suture very distinct, one-half around; color reddish brown on the shaded side, with a brownish purple in the sun, and dotted with fawn-colored specks, and covered with an abundant blue bloom; flesh rather dry, yellowish amber in color, firm, very rich, sugary, excellent; pit quite small, compressed, nearly free. The trees are as yet too young to determine their fruitfulness, but it seems to be a promising variety for dessert purposes. Season August 23; size medium to large.

Czar.—Tree quite vigorous and of an upright habit. Fruit roundish ovate; stalk one-half inch long, rather slender; cavity regular, narrow; apex slightly sunken; suture a mere line, one-half around; color dark purple, with a light blue bloom; flesh moderately juicy, pale amber, firm, sweet, vinous, very pleasant; pit free; quality good; season August 4; size medium to large. Thus far somewhat lacking in productiveness; shoots stout and with shouldered buds.

Tabulation of Plums—Prunus—1898.

Abbreviations—Form: l, long; o, oval; ob, obovate; r, roundish. Color: b, black; g, greenish; p, purple; r, red; w, whitish; y, yellowish. Adhesion: c, cling; f, free; s, semi-cling.

Number.	Names.	Species.	Planted.	Vigor.—scale 1-10.	Bloomed.	Ripened.	Form.	Color.	Adhesion.	Weight of specimen in ounces.	Productiveness scale 1-10.	Quality—scale 1-10.
1	Abundance	Triflora	1895	9	Apr. 28	Aug. 6.	r o	r	c	⅔	10	5 6
2	Agen Prune	Domestica	1890	10	May 2	" 9	o	p	f	1	1	6 7
3	Archduke	Domestica	1892	9	" 2	" 9.	r o	b	f	2	few	3 4
4	Arctic	Domestica	1890	10	" 7	" 16.	r o	b	f	½	7 8	5
5	Bavay	Domestica	1890	10	Apr. 30.	Sept. 29.	r	g y	c	1½	7	10
6	Black Diamond	Domestica	1892	10	" 30	" 8.	o	b	f	2	7	5 6
7	Botan	Triflora	1890	8	" 27	Aug. 5.	r o	r	c	1	5 6	5 6
8	Bradshaw	Domestica	1890	9	May 7	" 20.	r o	r p	s	2⅛	1	6 7
9	Burbank	Triflora	1893	10	Apr. 28	" 4.	r	y r	c	2	10	6
10	Burbank 2 (is Abundance)	Triflora	1890	9	May 3	" 10	r o	r	c	1	10	5 6
11	Coe	Domestica	1893	9	" 5	Sept. 23.	l o	y	c	2	few	8
12	Columbia	Domestica	1893	8 9	" 10	Aug. 23.	r	p	f	2	5	7 8
14	Czar	Domestica	1892	9 10	" 5	" 4.	r o	p	f	1	2	7 8
15	Engle	Domestica	1890	9	" 3	" 8.	r o	y g	f	1	4	7 8
16	Englebert	Domestica	1890	10	" 2	Sept. 8.	r o	b	f	1	4 5	6 7
17	G. No. 4	Domestica	1890	10	" 5	Aug. 11.	r	p	c	1	1	7 8
18	Grand Duke	Domestica	1890	10	Apr. 30	Sept. 9.	o	p	c	1⅓	2	5
19	Guii	Domestica	1890	8 9	May 9	Aug. 24.	r	p	f	1	1	5 6
20	Hungarian	Domestica	1888	10	" 7	" 20.	r	p	f	1	8 9	6 7
21	Kingston	Domestica	1890	10	" 2	" 24.	o	b	c	2	8 9	6
22	Lincoln	Domestica	1890	10	" 7	" 10.	r o	r p	f	2	2	8
23	Lombard	Domestica	1891	8 9	" 7	" 22.	r	p	c	1⅓	4	5
24	Long Fruited	Triflora	1890	10	" 3	July 16.	r	r	f	½	3 4	2 3
25	Mariana	Cerasifera	1890	10	" 9	Aug. 10.	o	r	c	1⅓	few	6 8
26	Maru	Triflora	1890	8	" 3	" 23.	r	r	c	1¼	1	5
27	McLaughlin	Domestica	1893	7	?	Sept. 29.	r o	g y r	---	2½	few	10
28	Middleburg	Domestica	1890	10	May 3	" 18.	r o	y p	f	1	3	8
29	Monarch	Domestica	1893	9	" 2	" 22.	o	p	f	2¼	5	7
30	Moreman (very small this year)	Hortulana	1890	10	" 14	July 26.	ob l o	r	c	⅛	1	6
31	Nicholas *White*	Domestica	1890	9	" 9.	Aug. 22.	r ro	p	c	1⅛	1	5 6
32	Ogon	Triflora	1890	10	" 2	July 26.	r	y	f	1	1	2 3
33	Red June	Triflora	1894	10	Apr 30	Aug. 10.	r o	r p	c	1	10	8 9
34	Red Nagate	Triflora	1890	8 9	May 4	" 20.	r o	r	c	1¾	8 9	5 6

35	Robinson	Angustifolia	1890	8	May 14	Aug. 21.	r	r	c	¾	4 5	5
36	Saratoga	Domestica	1890	10	" 9	" 12.	r o	p	c	1¾	4	6 7
37	Satsuma	Triflora	1890	10	Apr. 30	" 30.	r o	r p	c	2	10	7 8
38	Shipper (Pride)	Domestica	1890	10	May 9	" 15.	o	b	c	1⅜	1	5 6
39	Shiro Smomo	Triflora	1890	8	" 2	July 26.	r o	r p	c	1	1 2	5 6
40	Shropshire	Domestica	1890	10	" 9	Oct. 6.	r o	b	c	1	9 10	6 7
41	Simon	Simoni	1888	8	" 1	Aug. 4	r	y r	c	2½	2	1 3
42	Spanish King	Domestica	1890	8	" 9	" 22.	r o	p	c	1½	4 5	5
43	Spaulding	Domestica	1890	10	" 4	" 20.	o	y	c	1⅓	4 5	8 9
44	Victoria	Domestica	1890	9 10	" 7	" 12.	o	r	f	2	5	6 7
45	Wangenheim	Domestica	1890	10	" 9	" 19.	o	b	f	¾	5	5
46	Wickson	Triflora	1895	7 8	" 2	" 25	r o	y r	c	2⅔	1	5 6
47	Yosebe	Triflora	1890	8 9	" 2	July 20.	r	r	c	½	1 2	2 3

Diamond, *Black*.—Tree quite vigorous, upright, with its branches somewhat spreading; fruit oval, with one side generally enlarged; stalk five-eighths inch long, stout; cavity narrow; apex scarcely noticeable; suture slight; color black with a dense bluish white bloom, flesh moderately juicy, pale amber, firm, with a pleasant, vinous flavor; pit long, oval, pointed, and with a very slight adherence; quality good. Season September 8; fruit quite large and generally quite productive. Although evidently distinct, this variety is quite similar to Kingston.

Englebert.—Tree strong growing, with a dense upright, roundish head. Fruit roundish, oval; stalk one-half inch long, stout; cavity none; apex sunken; suture distinct towards the apex; color black with a plentiful blue bloom; flesh juicy, amber, sweet, rather rich; pit small, oval, free; quality good. Season September 8; size medium, moderately productive. Young wood smooth.

Field.—Tree quite productive, with an upright head but with slightly spreading branches. Fruit oval, regular; stalk one inch long, moderately stout; cavity narrow, slightly; apex indistinct; color black with a thin blue bloom; flesh tender, moderately juicy, pale amber, quite firm, mild; pit cling; quality good. Season August 24, size large. In tree and fruit resembling Bradshaw, but slightly earlier and with somewhat smaller fruits than those of that variety.

French *Damson*.—Tree quite vigorous, with a dense roundish or slightly upright head; fruit roundish, inclined to oblong; stalk one-half inch long, slender; cavity very slight; apex indistinct; suture hardly perceptible; color black, with numerous gray specks and with a slight blue bloom; flesh juicy, pale, dull green, firm, sweet; pit small, flattened, roundish, oval, cling; quality good. Season September 18; size small. Thus far lacking in productiveness. Young wood slender, brownish.

Giant *Prune*.—Trees moderately vigorous, upright or slightly spreading, with very stout branches. Fruit ovate, slightly necked; stalk one-half inch long, stout; cavity none; apex indistinct and suture well marked, one-half around; color dark purple, specked with many yellowish dots; bloom slight, bluish; flesh juicy, amber colored, tender, sweet, pleasant; pit long, oval, pointed, nearly flat, free; quality good. Season September 20; size large. Trees too young to give an idea of their probable productiveness.

Glass.—Tree very vigorous, with strong, upright branches and slightly spreading shoots. Fruit oval; stalk one-half inch long, stout; cavity broad and deep; apex slightly depressed; suture shallow; color purplish black, with an abundant blue bloom; flesh moderately juicy, pale amber, firm, fine grained, mild, pleasant; pit plump, roundish, oval, cling. Season August 10; size large; young wood smooth, dark reddish brown. One of the most satisfactory trees in the plantation and it promises to be a productive variety.

Grand Duke.—Tree moderately vigorous, upright, with spreading branches. Fruit ovate, tapering towards the stalk, which is one inch long, stout; cavity narrow, shallow; apex distinct, suture well marked; color black with a dense blue bloom; flesh juicy, pale yellowish orange, firm, vinous; pit oval, rather plump, cling, quality good. Season September 1; size large to very large; young wood rather stout; generally quite productive. One of the best of the large late sorts.

Guii.—Tree quite vigorous, spreading, upright. Fruit roundish, slightly ovate; stalk one-half inch long, rather slender; cavity narrow, slightly depressed; suture scarcely perceptible; color dark brown, nearly black with a slight bluish bloom; flesh juicy, light amber, tender, sweet; pit small, oval, pointed, free; quality very good; season August 24; size large; generally quite productive; young wood reddish brown. One of the most valuable varieties of its season.

Hungarian.—Tree quite vigorous, with a round, upright head. Young wood reddish brown. Fruit roundish; stalk one-half inch long, stout; cavity medium size, rather deep; apex often slightly depressed; suture very slight; color dark purple or black, with an abundant blue bloom; flesh juicy, tender, light amber, quite firm, mild, pleasant; pit plump, roundish, oval, free; quality good. Season August 20; size medium to large; quite productive.

Kingston.—Tree quite vigorous, roundish, upright, spreading. Young wood stout, grayish brown. Fruit oval; stalk three-fourths inches long; cavity narrow, rather deep; apex prominent; suture distinct, one-half around; color black with a dense bluish-white bloom; flesh juicy, tender, light amber, sprightly; pit long, oval, cling; quality good; season August 31; size large to very large. An early and abundant bearer, and a valuable variety for market purposes.

Lincoln.—Tree quite vigorous, roundish, spreading, with an upright growth; young wood grayish-brown. Fruit roundish oval; stalk one inch long; cavity narrow, shallow; apex sunken; suture slight, extending one-half around; color pale reddish violet, profusely sprinkled with brown specks and with a fine bluish-white bloom; flesh rather fine grained, moderately juicy, pale amber, rather firm, tender, very mild, sub-acid, pleasant; pit rather large, oval, flat, free; quality quite good. Season August 10; size large to very large. A strong growing and productive variety that appears to be promising for either home use or market, if its tendency to rot can be controlled.

Lombard.—Tree quite vigorous, with an upright, spreading habit. Fruit roundish, slightly oblong; stalk five-eighths inch long; cavity narrow and deep; apex slightly depressed; suture scarcely perceptible; color violet-purple, with a pale blue bloom; flesh juicy, yellow, tender, mild, pleasant; pit rather large, oval, pointed, plump, cling; quality good. Season August 22; size medium to large; generally very productive. A valuable variety for home use, but it has been extensively planted so that all of the large markets are overstocked, and it has not been a valuable shipping sort for some years. In some sections it is being top-worked with Monarch and other large late sorts.

Lyon, *Bailey*.—Trees upright, spreading, quite vigorous; young wood of a reddish brown. Fruit round or slightly oval; stalk one inch long, moderately stout; cavity narrow, slight; apex depressed, suture slight, one-half around; color bright, clear yellow with a slight bloom; flesh moderately juicy, yellow, tender, rich, sweet, vinous; pit large, oval, plump, nearly free; quality quite good. Season September 1; size large; generally quite productive. A promising variety brought to notice by S. S. Bailey of Grand Rapids, Mich., and re-named by the Michigan Horticultural Society.

McLaughlin.—Tree moderately vigorous. Fruit roundish oval; stalks three-fourths inch long, slender; cavity narrow, small; apex indistinct; suture scarcely perceptible; color greenish yellow, with stripes and specks of dark red, and with a whitish bloom; flesh very juicy, clear yellow, tender, rich, sweet, excellent; pit small, semi-cling. Season September 29; size large. A plum of the highest quality, and promising for market if sufficiently productive.

Middleburg.—Tree quite vigorous, upright, with rather spreading branches. Fruit roundish oval; stalk one to one and one-half inches long, stout; cavity broad, slight; apex indistinct; suture unmarked; color greenish yellow, nearly covered with reddish-brown and with a purplish color on the exposed side; bloom thin, light blue; flesh moderately juicy, light amber, rather firm, vinous, sprightly, rich; pit small, nearly round, free; quality very good. Season September 18; size medium; fairly productive.

Moldavka.—Rather vigorous, upright, spreading. Fruit long, ovate; stalk stout, one inch long; cavity rather deep, abrupt; apex obscure; suture indistinct, one-half around; color pale yellow, with a scarcely perceptible bloom; flesh moderately juicy, pale yellowish amber, moderately firm, mild, pleasant; pit long, ovate, pointed, flat, free; quality good. Season September 1; size large. A handsome fruit, but the tree has shown itself to be but moderately productive.

Monarch.—Tree quite vigorous, upright; young wood slightly red. Fruit ovate, compressed, with one side somewhat enlarged; stalk seven-eighths inch long, medium size; cavity rather deep and narrow; apex scarcely perceptible; suture broad, shallow; color deep purple, almost black, with a moderate blue bloom; flesh moderately juicy, light yellowish amber, rather firm, mild, vinous, sweet; pit long, oval, rather plump, with a slight adherence; quality quite good. Season September 22; size quite large. One of the most promising varieties for market purposes.

Murdy.—Tree strong growing, upright. Fruit roundish, oval; stalk three-fourths inch long, stout; cavity narrow, rather deep; apex, imperceptible; suture slight, one-half around; color reddish purple with many yellowish dots and specks and a light blue bloom; flesh moderately juicy, amber, tender, sweet, vinous, rich; pit oval, pointed, moderately plump, cling; quality very good. Season September 16; size large; as yet rather unproductive, but if this quality develops, it bids fair to become a valuable market sort.

Nicholas *White*.—Tree quite strong, roundish, upright. Fruit roundish to roundish oval; stalk three-fourths inch long; cavity small; apex quite distinct; suture very slight; color purple, numerously sprinkled with small yellowish dots, and with an amber, bluish bloom; only moderately juicy, pale amber, firm, vigorous, sprightly, rather rich; pit large, oval, plump, cling; quality good. Season August 22; size medium to large. Appears to be lacking in productiveness.

Saratoga.—Tree very vigorous, upright, slightly spreading; young wood olive brown; fruit oval, roundish; stalk one inch long, moderately stout; cavity narrow, deep; apex generally slightly depressed; suture indistinct, two-thirds around; color dull dark red or purple, violet in the shade, profusely sprinkled with minute grayish dots, bloom thin, lilac; flesh tender, juicy, dull yellow or pale amber, moderately firm, mild sub-acid, pleasant; pit oval, pointed, cling; quality good. Season August 12; size large. As yet not very productive.

Shipper *Pride.*—Trees quite vigorous, roundish, upright. Fruit medium size, oval, with one side slightly enlarged; cavity rather broad and shallow; stalk stout, three-fourths inch long; apex indistinct; suture well marked; color black with a plentiful blue bloom; flesh juicy, quite firm, of an amber color, and with a sweet, pleasant and sprightly flavor; pit rather large, pointed, moderately plump, cling; quality good; season August 23; moderately productive; young wood reddish brown, twigs coarse. Although a good shipping sort, the small size and firmness of the fruit make it of little value.

Shropshire *Damson.*—Trees vigorous, with a dense upright head. Fruit small, although large for the Damson, roundish, oval; cavity none; stalk medium size, three-fourths inch long; apex scarcely perceptible; suture very slight; color black with a blue bloom; flesh juicy, tender, pale green, high flavor; pit small, oval, pointed, a partial cling; quality poor; generally quite productive; season September 20. Valuable for market and culinary purposes.

Spanish.—Trees quite vigorous, rather upright; fruit medium to large, roundish, slightly inclined to oval; cavity narrow, deep, stalk stout, five-eighths inch long; apex and suture hardly marked; color reddish purple, with a bluish bloom; flesh firm and juicy, light amber, with a mild, vinous, nearly sweet flavor; pit medium size, oval, cling; quality fair; quite productive; season August 25; young wood reddish brown. Although rather small, it may have some value as a market sort.

Spaulding.—Trees vigorous, with a roundish, upright head. Fruit medium to large, nearly oval; cavity medium size, shallow; stalk three-fourths inch long, medium size; apex indistinct; suture distinct, one-half around; color yellowish green, faintly mottled with a slight whitish bloom; flesh tender, moderately juicy, amber with a sweet, sprightly, pleasant flavor; pit cling; quality good; season September 1. The trees are small, and as yet are somewhat lacking in productiveness, but it appears to be a promising variety for home use and possibly for market.

Victoria.—Trees quite vigorous, upright, with spreading branches. Fruit medium to large with one side much enlarged; cavity narrow, slight; stalk rather stout, one inch long; apex scarcely perceptible; suture deep, one-half around; color violet red, with numerous yellowish gray dots and specks, and with delicate lavender bloom; flesh moderately juicy, firm, pale yellowish amber, with a mild, nearly sweet flavor; pit oval, flat, free; quality good; season August 20; quite productive; young wood reddish brown. A promising variety for dessert purposes, but not likely to become a valuable market sort. The fruit has rotted badly for several years.

Wangenheim—Trees quite vigorous, with a roundish, upright head, and somewhat spreading branches. Fruit medium size, ovate, slightly enlarged on one side; cavity small, shallow; stalk slender, one-half inch long; apex and suture hardly noticeable; color black, with abundant blue bloom; flesh very firm, tender, moderately juicy, sweet, amber colored; pit small, oval, free; quality fair; season August 25; fairly productive. The small size of this fruit renders it of little promise.

Yellow Egg.—Trees quite vigorous, upright, slightly spreading. Fruit medium to large, oval, with one side slightly enlarged; cavity not marked; stalk stout, one inch long; apex slightly sunken, with a well defined suture, one-half around; color pale yellow, with numerous white dots and a slight whitish bloom; flesh coarse, tender, moderately juicy, of a yellow color and a sweet, vinous flavor; pit oval, plump, small, cling; quality fair; season September 15. Generally quite productive and a fairly valuable variety for market or culinary purposes.

Japanese Plums.

Abundance.—Tree quite vigorous, upright in growth. Fruit roundish, narrowing towards the apex; stalk one-half to three-fourths inch long, quite stout; cavity small, moderately deep; suture very marked, one-half around; apex prominent; color, reddish purple at maturity; with a splendid light lilac bloom; flesh juicy yellow, tender, pleasant and mild; pit plump, oval, clinging; ripe August 8; weight two-thirds ounce; very productive; quality good; young wood rather slender, of a dark reddish brown. An early bearing productive sort, and although it flowers early, it is one of the hardiest of the Japanese varieties.

Botan.—Tree rather vigorous, spreading. Fruit roundish, narrowing towards the apex; stalk one-half inch long, stout; cavity medium size, open; apex quite prominent; suture distinct; color reddish purple, thickly sprinkled with yellowish dots and specks; bloom moderate, light lilac; flesh very juicy, bright yellow, tender, mild, pleasant; pit small, oval, quite plump, cling; quality good; ripe August 8; size medium to large. Generally quite productive.

Burbank.—Tree quite vigorous, very spreading. Fruit roundish, tapering slightly towards the apex; stalk three-fourths inch long; cavity broad and deep; apex prominent; suture a mere line; color dark red on a yellow ground, with a slight whitish bloom and numerous yellow specks; flesh juicy, pale orange, tender, mild, vinous, pleasant; pit cling. Generally very productive. Ripe August 4; size quite large; young wood dark olive. Owing to the size and productiveness of the variety, it is one of the most valuable of the Japanese plums for home use or for market purposes.

Burbank No. 2.—Tree moderately vigorous, upright in habit, with slightly spreading branches. Fruit roundish; stalk three-eighths inch long, stout; cavity slight; apex prominent; suture distinct, one-half around; color dark red, with a profuse sprinkling of yellowish specks; bloom delicate lilac, plentiful; flesh juicy, tender, yellow, firm, with a sprightly and rich flavor; pit small, oval, cling; quality rather good. A productive variety, ripening August 10. Fruit medium to large. Young wood rather slender, of a glossy reddish brown.

Burbank No. 7.—Tree rather vigorous with a round head, and with upright or slightly spreading branches. Fruit roundish, oblong; cavity narrow, deep; apex slightly sunken; suture broad, shallow; color greenish yellow, bloom bluish white; flesh juicy, pale yellow, rather firm, mild and vinous; pit plump, roundish oval and semi-cling; quality good. Season September 15. Fruit medium to large. An early productive variety.

Maru.—Tree quite vigorous, upright, spreading. Fruit nearly round, but with a slight conical form; stalk one and one-half inches long, rather stout; cavity rather broad and deep; apex an enlargement at the end of the suture; suture not distinct, but the fruit is slightly uneven; color dark red, with a slight lavender; flesh juicy, orange yellow, moderately firm and vinous; pit round, plump, cling; quality fair. Season August 23; size medium, generally quite productive. Its comparatively small size and inferior quality make it less valuable than Burbank and some of the other Japanese sorts.

Ogon.—Tree strong growing, rather upright; fruit round; stalk one-half inch long, stout, separates readily from fruit; cavity narrow, shallow; apex even with surface; suture one-half round, indistinct; color pale yellowish white with a slight whitish bloom; flesh firm, juicy, pale yellow or amber, tender with a sweet but slightly unpleasant flavor; pit free; quality rather poor. Season July 26; size medium to large. A profuse bearer but too poor in quality and too unattractive to become popular.

Red June.—Tree quite vigorous, upright. Fruit roundish to roundish ovate; stalk one-half inch long, stout, generally remains on the spurs; cavity shallow, regular; apex prominent, slightly conical; suture distinct, more than one-half around; color dark reddish purple, with many yellow dots and a light lilac bloom; flesh yellow, fine grained, tender, juicy, mild, rich, sweet, very good; pit rather small, oval, moderately plump, quite firm; quality good. Season August 10; size large to very large. A very promising variety either for home use or market.

Red Nagate.—Quite vigorous with a roundish, upright head. Fruit roundish, ovate, tapering towards the apex; stalk one half inch long, stout; cavity rather broad and deep; apex not distinct; suture well marked, one-half around; color dark, dull red, with minute yellow specks; bloom light, lilac; flesh very juicy, yellow, tender, sweet; pit small, oval, plump, cling; quality good. Season August 20; size large to very large, quite productive. Resembles Red June in most respects, but it seems to be ten days later.

Satsuma.—Trees quite vigorous, somewhat upright but with spreading branches. Fruit large, roundish, with one side enlarged; cavity medium; stilk five-eighths inch long, stout; apex distinct, conical; suture distinct; color dark purplish red, with many minute yellowish specks and a slight pinkish bloom; flesh dark purple, tender, juicy, with a mild, vinous flavor; pit small, oval, moderately plump, cling; quality good; ripe August 20; quite productive; young wood brownish red. One of the most desirable varieties for canning purposes.

Shiro Smomo.—Trees quite vigorous with a roundish head. Fruit small, roundish, a slight bluish white bloom; flesh fine grained, tender, moderately juicy, whitish ovate, with one side slightly enlarged; cavity broad and rather deep; stalk one-half inch long; apex prominent; suture distinct, one-half around; color dark purple with yellow; pit cling; quality fair; season July 28; fairly productive. Although a very early variety, the small size of the fruit renders it of little value.

Wickson.—Trees fairly vigorous, upright, with small, narrow foliage. Fruit very large, roundish, conical, tapering to the apex, which is prominent; cavity rather narrow, deep, regular; suture distinct, one-half around, one side of the fruit enlarged; color deep yellowish amber, with splashes of red over most of the surface, except at the tip; flesh quite firm, moderately juicy, with a very pleasant, vinous flavor; color of flesh yellow; pit ovate, flattened, cling; season August 18. The young trees seem to be hardy and quite productive, and although the fruit is not of the highest quality, its large size and handsome appearance tend to make it a very promising variety.

Yosebe.—Trees quite strong growing, with an upright, round head and somewhat spreading branches. Fruit small, roundish, with a narrow cavity and a short, stout stalk, from which the fruit usually drops, leaving it on the trees; apex rather prominent, with a distinct suture, one-half around; color reddish brown, with numerous amber specks and a very fine lilac bloom; flesh firm, moderately juicy, light amber, with a mild but bitter flavor; pit small, oval, semi-cling; quality rather poor; season July 15; the small size and inferior flavor of the fruit make it of little value, its only claim being on account of its extreme earliness.

L. R. TAFT.
T. T. LYON.

Agricultural College, Michigan, February 1, 1899.

VEGETABLE TESTS FOR 1898.

BY L. R. TAFT. H. P. GLADDEN AND M. L. DEAN.

Bulletin 170.—Horticultural Department.

A large number of new varieties of vegetables are sent out each year. We have continued the practice of former years of securing seeds and testing their merits. In some cases we have been able to obtain them from the originators before they had been placed upon the market, but, for the most part, have had to secure them from the seedsmen by whom they are being introduced. While there has been considerable change in the varieties grown today as compared with those in cultivation ten years since, the difference is greater in the names than in the varieties themselves, as in many cases, although the name has been changed, a careful trial of many of these varieties shows that they are nothing more than improved strains of some of the old kinds. The change that has been brought about has been secured largely by selection, and if it is sufficiently marked to make any difference in the value of the variety, the seedsmen are justified in applying a new name to it. Particular attention is called to the results secured from the use of a number of fungicides as preventives of the scab upon potatoes.

BUSH BEANS.

The following sorts have not been described in previous bulletins:

California Wonder.—From Northrup, King & Co., Minneapolis, Minn. Plants of low, straggling growth, with light green foliage. Edible August 5. Pods four to four and one-half inches long, straight, flattened and green in color; their quality is excellent and they remain a long time in edible condition. The variety is very productive of pods but late in maturing.

Dwarf Lyonnaise.—From J. M. Thorburn & Co., New York. Plants of strong, upright growth and foliage of dark green color. Edible August 5. Pods six to seven inches long, green, twisted and curved, very tender, snappy, and sweet in quality. The plants were unproductive and the variety late in maturing edible pods.

Earliest Hardiest.—T. W. Wood & Sons, Richmond, Va. Plants are of small, unhealthy growth. Foliage light green in color and badly rusted. Edible July 22. Pods are five to six inches long, narrow and flattened, green in color. The quality is good, but the plants were so weak in growth that very few pods were borne.

Jones Round Pod Wax.—From Jas. Vick's Sons, Rochester, N. Y. Edible July 22. Pods four to six inches long, curved, greenish yellow in color. The quality is high and the variety is early in maturing. A good yellow-podded sort.

Jones Stringless.—From D. M. Ferry & Co., Detroit, Mich. Edible July 23. Quite similar to preceding but much more productive, and the pods are of a golden yellow color and the beans are larger and more nearly round. A most excellent wax bean for its high quality, productiveness and long season.

No. 1.—From Peter Henderson & Co., New York. Plants of strong, healthy growth. Edible July 20. Pods seven to eight inches long, broad and flattened, dark green in color, tender and of excellent quality. The plants are very productive. It was the earliest variety to mature edible pods. A most valuable green-podded bean.

Rogers' Lima Wax.—From H. W. Buckbee & Co., Rockford, Ill Plants of low, stocky growth. Edible August 1. Pods three to four inches long, straight, flattened, and of a rich golden yellow color. The variety is tender in pod and of very fine quality. It remains in edible condition a long time without becoming tough. The pure white beans are excellent for baking. The plants were scarcely productive enough, but otherwise it is a very promising variety.

Bush Beans, Planted May 31.

Variety.	Seedsman.	Date edible.
Black Valentine	Peter Henderson & Co., New York	July 23
California Wonder	Northrup, King & Co., Minneapolis, Minn.	Aug. 5
Crystal White Wax	H. W. Buckbee & Co., Rockford, Ill.	July 28
Cream Valentine	Peter Henderson & Co., New York	" 22
Cylinder Black Wax	Peter Henderson & Co., New York	" 28
Davis Wax	D. M. Ferry & Co., Detroit, Mich.	" 26
Detroit Wax	D. M. Ferry & Co., Detroit, Mich.	" 23
Dwarf Horticultural	W. W. Rawson & Co., Boston, Mass.	" 26
Dwarf Lyonnaise	J. M. Thorburn, & Co., New York	Aug. 5
Earliest Hardiest	T. W. Wood & Sons, Richmond, Va.	July 22
Electric Tree	H. W. Buckbee & Co., Rockford, Ill.	Aug. 18
Goddard	D. M. Ferry & Co., Detroit, Mich.	July 28
Golden Wax	D. M. Ferry & Co., Detroit, Mich.	" 21
Improved Goddard	D. M. Ferry & Co., Detroit, Mich.	" 28
Jones Round Pod Wax	Jas. Vick's Sons, Rochester, N. Y.	" 22
Jones Stringless	D. M. Ferry & Co., Detroit, Mich.	" 23
Mohawk	D. M. Ferry & Co., Detroit, Mich.	" 22
No. 1	Peter Henderson & Co., New York	" 20
Rogers' Lima Wax	H. W. Buckbee & Co., Rockford, Ill.	Aug. 1
Stringless Green Pod	W. Atlee Burpee, Philadelphia, Pa.	July 22
Stringless Valentine	Johnson & Stokes, Philadelphia, Pa.	" 25
Triumph of the Frames	H. A. Dreer & Co., Philadelphia, Pa.	" 28
Valentine Wax	D. M. Ferry & Co., Detroit, Mich.	" 21
Valentine Wax	Sunset Seed Co., San Francisco, Cal.	" 21
Yosemite Mammoth Wax	Sunset Seed Co., San Francisco, Cal.	" 28

Stringless Valentine.—From Johnson & Stokes, Philadelphia, Pa. Plants of strong, healthy growth; foliage dark green. Edible July 25. Pods five to six inches long, round, nearly straight, dark green. It is not so early as Red Valentine, but the pods are less stringy and have a longer season. An excellent green-podded variety.

Triumph of the Frames.—From H. A. Dreer & Co., Philadelphia, Pa. Plants are of weak growth and bear few pods. Pods are long, narrow, flattened, dark green, tender, juicy and of fine flavor, but are too thin and narrow for substance.

Summary of Varieties.

The following wax sorts have given the best satisfaction here: Cylinder Black Wax, Davis Wax, Golden Wax and Jones Stringless. Among the better green podded sorts would be Red Valentine, Stringless Green Pod and Stringless Valentine.

POLE BEANS.

The unusual exemption from early frosts, during the fall of 1898, gave an opportunity for some varieties of pole beans to mature that in ordinary seasons would not have done so in this locality.

Black Lima.—A very productive variety, bearing small pods that contain three to four small, purplish-black beans. It usually does not mature before the plants are killed by frost.

Challenger.—Plants of strong, vigorous growth and bear large pods that are filled with large, thick, white beans of good quality. An excellent market sort.

Golden Cluster.—Perhaps the best pole bean for snap purposes. The large pods are tender, of very good quality and produced abundantly until the plants are killed by frost.

Golden Lima.—While not so strong-growing as some, the plants are fairly productive and the pods contain from three to five large, golden yellow beans of very high quality. A fine variety.

Holstein.—Of little value as a snap bean, but its productiveness and early maturity make a place for it as an early shell bean.

Mastiff.—Much like Golden Cluster, but its season is a little later.

Powell Prolific.—Plants of vigorous growth and very prolific. Pods green, very handsome in appearance, with solid flesh of the finest quality.

Pole Beans, Planted June 7.

Variety.	Seedsman.	Date edible.
Black Lima	W. Atlee Burpee, Philadelphia, Pa.	Sept. 23
Challenger	D. M. Ferry & Co., Detroit, Mich	" 6
Golden Cluster	D. M. Ferry & Co., Detroit, Mich.	Aug. 19
Golden Lima	H. W. Buckbee & Co., Rockford, Ill.	Sept. 8
Holstein	H. W. Buckbee & Co., Rockford, Ill.	Aug. 15
Mastiff	J. J. H. Gregory, Marblehead, Mass.	" 23
Powell's Prolific	A. W. Livingston's Sons, Columbus, Ohio	" 21
Seibert's Early Lima	D. M. Ferry & Co., Detroit, Mich.	" 26
Unnamed	Frank Banning	" 15
White Sickle	D. M. Ferry & Co., Detroit, Mich.	Sept. 2
Willing's Pride	John A. Salzer, LaCrosse, Wis.	Aug. 22
Willow Leaf	W. Atlee Burpee, Philadelphia, Pa.	Sept. 29

Seibert Early Lima.—Plants strong growing and productive. Pods large, broad and contain three to four beans that are excellent in quality. One of the earliest and most valuable of the pole Limas.

Unnamed.—The plants are not of tall growth, but are bushy and vigorous. Pods green, four to five inches long, straight, somewhat fuzzy, but of good quality when small. Productive and an excellent shell bean.

White Sickle.—Much like Old Homestead, but the beans are white.

Willing's Pride.—Pods are very long, green, tender and the quality is of the best. A good green-podded pole bean.

Willow Leaf.—Plants of strong growth, unique in foliage and quite ornamental. Usually matures pods too late for ordinary seasons here.

CABBAGE.

The seed of the early varieties of cabbage was sown March 15, in boxes in the forcing house; medium sorts April 25, and the late ones May 17. As soon as the plants were of proper size they were pricked out into flats, and were left in them till the proper time for transplanting to the field. The early varieties were put out May 17, the medium June 14 and the late sorts July 6.

The early and medium sorts were on rich, sandy loam, but the extremely hot weather of July and August would have ruined them had it not been for the use of the irrigating system. They were watered about the time the heads were starting and at intervals of five to eight days, as the condition of the weather required, until the heads were well developed. The late sorts were on reclaimed swampy land, and did not need irrigating.

The bacterial black rot of the cabbage attacked the late varieties quite badly, completely destroying several sorts and checking the growth of others to such an extent that it was impossible to find typical specimens for description or comparison.

The early varieties included a few that have not been described in the bulletins of 1896 and 1897.

Among the early varieties one might select All Head Early, Bullock Heart, the Wakefields, Early Spring and Early Summer, all of which gave a large percentage of heads, and were quick growers and of good quality.

Paris Savoy, from Vaughan, is a vigorous grower, but can be planted closely. The heads are very compact, of a bright green outside, but the inner parts are of a rich cream color, and have a flavor hard to excel. The stem is of medium length, upright and stout. This is a valuable addition to the list of early cabbages for those who like the tender leaves and mild flavor of the Savoy.

Queen, one of the Buckbee novelties, promises to be of value as an early variety. The plants were strong and very true to type; foliage thick, leathery and of a light green color, with bluish-white bloom. The heads are slightly flattened, very solid, crisp and tender; in flavor one of the best. Stem short, stout, upright.

Table of varieties.

Variety.	Seedman.	Season.	Date.		No. of days from planting to maturity.	Per cent of plants headed.	Average weight of heads, pounds.
			First mature head.	Market maturity.			
All Head Early	Burpee	Early	July 28	Aug. 10	84	60	4.66
" " "	Vaughan	"	" 28	" 10	84	75	5.3
Bloomsdale Bullock Heart	Landreth	"	" 30	" 12	92	80	5.8
Charleston Wakefield	Henderson	"	Aug. 3	" 12	92	98	3.5
Early Dwarf Flat Dutch	Landreth	"	July 26	" 5	79	61	2.33
" Jersey Wakefield	Henderson	"	" 28	" 8	82	77	5.1
" " "	Vaughan	"	" 27	" 12	94	81	4.75
" Paris Savoy	Vaughan	"	" 29	" 14	96	81	8.5
" Spring	Vaughan	"	" 29	" 10	84	90	5.75
" "	Henderson	"	" 28	" 10	84	93	4.75
" Summer	Vaughan	"	" 28	" 10	84	94	4.5
Etampes	Vaughan	"	" 28	" 12	86	71	4.75
Queen	Buckbee	"	" 29	" 14	88	85	3.25
Solid South	Wood & Sons	"	Aug. 4	" 16	90	80	4.5
Stein Flat Dutch	Vaughan	"	" 5	" 20	94	90	5.
Twiss Drumhead	Gregory	"	" 4	" 15	89	83	5.
Volunteer	Rawson	"	" 8	" 20	94	91	6.
Washington Wakefield	Northrup, King & Co.	"	July 28	" 10	84	82	4.75
All Seasons	Vaughan	Medium	Aug. 20	Sept. 4	101	98	5.1
Autumn King	Vaughan	"	" 30	" 15	111	85	4.8
" "	Henderson	"	" 30	" 15	111	60	4.2
Market Garedners' No. 2	Johnson & Stokes	"	" 30	" 10	111	90	4.7
Succession	Vaughan	"	" 18	" 1	99	95	6.3
"	Henderson	"	" 18	" 1	99	90	4.4
Treasure	Everitt	"	" 30	" 15	111	75	3.
Vandergaw	Vaughan	"	" 25	" 6	106	80	8.5
Number 1	U. S. Dept.	"	" 20	Aug. 24	91	98	2.
" 2	" "	"	" 15	" 30	96	90	4.
" 3	" "	"	Sept. 10	Sept. 15	110	85	3.8
" 4	" "	"	" 1	" 20	109	95	4.4
" 5	" "	"	Aug. 20	" 1	101	98	4.6
" 6	" "	"	" 15	Aug. 25	95	50	8.5

Solid South, from T. W. Wood & Sons, strongly resembles Early Summer, and equals it in every way except that it is a few days later. It would be a good substitute for some of the small early varieties.

Volunteer, Rawson, produced the largest heads among the early sorts, but did not reach maturity quite as soon. The plants are rank growers and have short, stiff stems. The foliage is bright green, with a bluish tint, thick and leathery, lapping well over the heads. The heads are compact, tender, crisp and have a very mild, desirable flavor.

Among the medium sorts, the only ones not previously described were six varieties received from the Department of Agriculture, Washington, D. C. Nos. 1, 3 and 6 grew more like Brussels Sprouts, forming several heads at the base of the leaves. The stems were long and on some plants there were six or eight heads about two inches in diameter, besides the larger head at the upper end of the stem. The heads were very solid, mild flavored, and had a sparse amount of foliage.

Nos. 2, 4 and 5 had the same tendency, but simply threw out small tufts of leaves from the sides of the stems. The terminal heads on these plants were larger, but about the same in quality. None of the varieties seemed to be true to any special type, and unless further trial should show decided improvements, they are of little value.

The surest headers, best flavored, medium season cabbages are All Seasons, Succession, Market Gardeners' No. 2 and Autumn King, all of which are standard sorts, either for market gardeners or for home use.

CAULIFLOWER.

Seven varieties of cauliflower were grown, viz.: Algiers, Autumn Giant, Extra Early Paris, Lenormands Short Stemmed Mammoth and Second Early Erfurt from D. M. Ferry & Co., Snowball from Henderson and Walcheren from Vaughan. They were handled the same as the cabbages and planted out with the medium varieties of cabbage. The cabbage disease attacked the plants early in their growth, and but few small heads developed.

KALE.

Curled Scotch, German Dwarf Purple, Green Curled Scotch, Half Dwarf Curled and Siberian, all from Ferry, is the list of kale grown.

Siberian is an addition to previous lists, and proved to be very much like Green Curled Scotch, except that the leaves are coarser, long and spreading, but very crisp and tender when mature. The kales are not much used, but should be in every garden, because of their attractiveness, the ease with which they can be grown and their pleasant flavor when cooked.

KOHL RABI.

Three varieties, Early Purple, Early White and Large Green from Ferry, constituted the list of Kohl Rabi. It is grown the same as the cabbage and develops a turnip-shaped swelling of the stem just above ground, which reaches five or six inches in diameter. When properly cooked, they are a valuable addition to the list of garden vegetables.

CUCUMBERS.

White Spine (Arlington).—From J. C. Vaughan, Chicago. The White Spine class is the general favorite for table use, and this is the type most largely grown for market purposes.

Beauty.—From J. Lewis Childs, Floral Park, N. Y. The form of the fruit is too short and thick for pickles or for slicing. It is one of the earliest sorts to mature.

Emerald.—From A. W. Livingston's Sons. The excellent form, handsome appearance and good quality of the specimens of this variety, together with its long season, make it one of the best for table use.

Fordhook, Jersey and Rockford Pickling are excellent sorts for pickles and for slicing. Rockford was the earliest in season.

Japanese Climbing.—From J. C. Vaughan. This variety has given excellent satisfaction for several seasons as one of the best sorts for pickling or for table use.

Table of varieties, Cucumbers.

Planted May 26.—Variety.	Seedsman.	Productiveness.	Date of pickling size.	Date of slicing size.	Date of ripening.	Average weight of a single fruit, ounces.
Arlington White Spine	J. C. Vaughan	70 %	July 18	July 24	Aug. 2	8.5
Beauty	J. L. Childs	80 "	" 14	" 20	July 27	7.
Emerald	A. W. Livingston & Son.	75 "	" 22	" 27	Aug. 7	10.
Fordhook Pickling	W. A. Burpee & Co.	90 "	" 19	" 24	July 29	9.5
Japanese Climbing	J. C. Vaughan	95 "	" 19	" 23	" 28	17.
Long Green	J. C. Vaughan	85 "	" 22	" 27	Aug. 5	17.5
Model	T. W. Wood & Sons	65 "	" 21	" 26	" 1	7.5
Perfected Jersey Pickle	Johnson & Stokes	95 "	" 24	" 30	" 4	7.75
Rockford Pickle	H. W. Buckbee	90 "	" 12	" 15	July 19	8.5
Short Green	D. M. Ferry & Co.	95 "	" 18	" 22	" 27	9.25
Siberian	J. C. Vaughan	80 "	" 11	" 14	" 18	6.5

Long Green.—A common sort largely grown for table purposes.

Model.—From T. W. Wood & Sons, Richmond, Va. Of White Spine type, though the fruits are more slender and tapering than that class.

Siberian.—One of the best early sorts for pickling or to furnish small fruits for slicing.

LETTUCE.

Seed for the varieties grown outdoors was sown in the forcing-house April 8, and the plants were set in the open ground May 18. The table below gives the data obtained from this planting.

Table of varieties.

Variety.	Seedsman.	Date of maturity.	Average weight of a single head.
Alaska	Sunset Seed Co.	June 29	1 lb 3 oz
All Seasons	J. C. Vaughan	July 5	11½ oz
Bronzed Curled	D. Landreth & Sons	June 30	1 lb 5 oz
Brown and Gold	J. C. Vaughan	" 25	13 oz
Crisp as Ice	A. W. Livingston's Sons	" 25	12½ oz
Denver Market	D. M. Ferry & Co.	" 29	1 lb 3½ oz
German Butter	J. A. Salzer	July 1	14 oz
Golden Curled	D. Landreth & Sons	June 30	1 lb 4½ oz
Grand Rapids	J. C. Vaughan	" 30	1 lb 5 oz
Green Fringed	J. C. Vaughan	July 1	11 oz
Hamilton Market	J. A. Bruce & Co.	" 1	1 lb 8½ oz
Heavy Weight	J. A. Salzer	June 28	11 oz
Hero	Jas. Vick's Sons	July 1	1 lb 6 oz
Iceberg	J. C. Vaughan	" 2	1 lb 13 oz
Lancaster	W. A. Burpee & Co.	June 29	1 lb 1 oz
Mammoth Cabbage	J. C. Vaughan	" 29	1 lb 3½ oz
Maximum	J. M. Thorburn	July 1	1 lb 4 oz
Morse	J. C. Vaughan	June 25	1 lb --
Myers All Right	Johnson & Stokes	" 29	13½ oz
New York	Peter Henderson & Co.	" 30	1 lb 5 oz
No. 2	Peter Henderson & Co.	" 22	12½ oz
No. 132	W. A. Burpee	" 27	1 lb 5 oz
Nonpareil Cabbage	J. A. Bruce & Co.	July 1	1 lb 8 oz
Prize Head	J. C. Vaughan	" 2	12½ oz
Rawson's Hot House	J. C. Vaughan	June 19	8½ oz
Salamander	Johnson & Stokes	" 30	10½ oz
Wonderful	H. A. Dreer	" 30	1 lb 11 oz

The following are recent introductions:

Alaska.—From Sunset Seed Co., San Francisco, Cal. It forms a loose cabbage head, fourteen to sixteen inches in diameter. The margins of the leaves are waved and curled and the surface is blistered. The color is light green. The leaves are tender but somewhat bitter.

Bronzed Curled.—From D. Landreth & Sons, Philadelphia. Forms a solid head eight to ten inches high with the leaves spreading twelve to fifteen inches. Somewhat of a Prize Head type but a lighter green and the heads are larger. Tender and the quality is of the best. A most excellent sort.

Crisp as Ice.—From A. W. Livingston's Sons, Columbus, O. Appears to be identical with Brown and Gold and is of the old Brown Dutch type.

Golden Curled.—From D. Landreth & Sons. Appears to be identical with Alaska, though the heads average slightly larger in size.

Hamilton Market.—From John A. Bruce & Co., Hamilton, Ont. It has a large, close head that is very tender and of the best quality. Much like Iceberg in habit, except that the outer leaves do not have the purple tinge. A fine outdoor sort.

Heavy Weight.—From J. A. Salzer, LaCrosse, Wis. A small-growing, close-heading variety that has little value compared with the many better sorts.

Hero.—From Jas. Vick's Sons, Rochester, N. Y. The type is not fixed. Some plants are a much darker green and more purple than others. A few plants formed loose heads, while others were open and spreading.

Lancaster.—From W. Atlee Burpee & Co., Philadelphia, Pa. Plants twelve to fourteen inches in diameter and eight inches high; light yellowish-green in color. The inner leaves are very much waved and close together, almost forming a head, but without folding as do the cabbage heading sorts. Tender and delicate in texture and of good quality. Attractive in appearance and a good variety.

Maximum.—From J. M. Thorburn, New York. A large dark green cabbage-heading sort of fair appearance and quality. The color is too dark to sell well in market.

Myers All Right.—From Johnson & Stokes, Philadelphia, Pa. A sort closely resembling German Butter, but the heads are closer and scarcely as large.

No. 2.—From Peter Henderson & Co., New York. The plants form a loose head of a bright yellowish-green color. The inner leaves blanch almost white and are of the best quality. A quick-growing sort but the plants are small.

No. 132.—From W. Atlee Burpee & Co., Philadelphia. Forms a loose head fourteen to sixteen inches in diameter and eight to ten inches high, of a light yellowish-green color. A large growing sort that remains a long time in condition before sending up a seed stalk. It is attractive in appearance and the quality is good. A fine variety.

Nonpareil Cabbage.—From J. A. Bruce & Co. The plants closely resemble those of Hamilton Market.

Salamander.—From Johnson & Stokes. A small heading sort, light yellowish-green in color. Tender and quality very good, but the heads are too small.

Wonderful.—From H. A. Dreer. Plants sixteen to eighteen inches in diameter and ten to twelve inches high. Of Iceberg type, but scarcely as close and firm heading, and a darker green color. The leaves are tender and the quality good. An excellent dark-colored variety.

Summary of Varieties.

For the forcing-house and hot-beds we have found no better variety than Grand Rapids of the loose- growing sorts. If a heading lettuce is desired for forcing purposes, Tennis Ball, Boston or Rawson's Hot House would give good results.

Of the varieties grown in the open ground, none has given better satisfaction than has Iceberg. It is a large-growing, close-heading variety, attractive in appearance and excellent in quality. It stands the heat well and remains a long time in condition. Hamilton Market, Morse, Prize Head and Wonderful are also good out-door sorts.

ONIONS.

The onions were grown in a sand loam that was not an ideal onion soil, but fairly good results were secured. Aside from the variety test, some work was with the Prizetaker by starting the seed under glass and transplanting to the field. The results were very satisfactory and showed that the large, late varieties of onions can be grown in that way, and that the work of transplanting was little if any more than the first hand-weeding, while a considerable saving of seed can be made.

Burpee's Australian Brown, so named from the home of its origin, is one of the best general purpose onions in our list. They are of a slightly flattened, globular form, averaging three inches in diameter, and one and three-fourths in thickness. They are of a brownish red color, and are very firm and solid. While they mature early in the season, they appear to be good keepers. The flavor is mild and pleasant.

Bermuda Red, from D. M. Ferry & Co., averaged the same in size, and about the same in firmness. The color was pale red; texture rather coarse, and flavor mild. This variety matured early and very evenly.

Delicatesse, from J. A. Everitt & Co., is a flat onion, mild in flavor, but rather soft and coarse. The color was a delicate pink, with a white center. They grew large, measuring four inches in diameter.

Extra Early Red, and Giant Rocca were both received from D. M. Ferry & Co. Early Red is a flat, slightly coarse, medium sized variety, rather strong in flavor. It is solid and of some value as an early market sort.

Giant Rocca reached a diameter of three inches and was nearly spherical in form. Our season is rather short for it to reach its full size. The color is light red: texture coarse; flavor medium.

Gladiator, J. A. Salzer Seed Co., is a globe-shaped onion, about three and one-half inches in diameter. The skin is thin, light red; texture coarse; flavor mild. The tops dried down early, and the bulbs, which were quite solid, matured in good season.

Mammoth Silver Skin, Marzajola, Michigan Yellow Globe, Prizetaker, Queen, Red Wethersfield, Southport Red Globe, Southport Yellow Globe, Southport White Globe, Italian, Perpetual, Round Silverskin, White Silverskin, Yellow Danvers and Yellow Dutch were recieved from D. M. Ferry & Co.

Michigan Yellow Globe was among the best, being nearly spherical in form and of high quality. It is valuable for commercial growing, as it is productive, attractive in appearance and a good keeper.

Prizetaker is especially valuable for sowing in hot-beds and transplanting. In this way it grows to a large size and the handsome appearance of the bulbs and their excellent flavor make it desirable for either home use or market. The bulbs are four inches in diameter and somewhat flattened.

Round Silverskin and White Silverskin are grown mostly for bunching or pickling. They are quick growers, forming small, tender, crisp bulbs that are very white and glossy, and have a mild, sweet flavor.

Yellow Danvers and Yellow Dutch are standard sorts of high quality.

Vesuvius Red, W. H. Maule, is an Italian onion which reached a diameter of four and one-eighth inches and was three and one-half inches thick; color bright red; texture rather coarse and a little soft; flavor mild. The tops were large and did not ripen off well.

PEAS.

Peas were sown May 16, in double drills forty-two inches apart. Each seed was given a space of about two inches, and covered to the depth of four inches. The soil was a rich, sandy loam, and the conditions of the weather were such that germination was rapid.

The list included sixty varieties, seven of which were grown and described several years ago; they were planted again this year to observe if the type had deteriorated, but the results showed that the varieties are still pure and quite productive, and indicate that careful selection is maintained by the leading seedsmen.

The seven varieties referred to are Bergen Fleetwing, Blue Beauty, Chelsea, Forty Fold, May, Rural New Yorker and William Hurst. It will be seen from the table of varieties that these rank well with the other sorts. The following kinds have also been described in our previous bulletins but were grown for comparison:

Admiral, Advancer, Alaska, American Wonder, Champion of England, Clipper, Extra Early, First and Best, Hancock, Maud S, Nott's Excelsior, Pride of the Market, Rural New Yorker, Stratagem, Surprise and Universal.

Peas may be divided into four classes, according to the height of the vines and various characteristics of seeds and pods. The varieties first described may be regarded as types of the several classes.

Class I.—Plants tall, averaging about four feet in height; seeds white, greenish or cream colored; pods slightly curved. There is no better variety in this class than Champion of England. Its quality and productiveness make it a desirable sort both for commercial purposes and the family garden.

Long Island Mammoth, one of Dreer's standard sorts, is a strong grower with very large, coarse leaves. The pods were extra large, but did not fill, which caused it to rank low in productiveness. The peas are wrinkled, greenish in color and of excellent quality, which places it among the desirable sorts.

Mammoth Luscious, from Maule, has vines four feet in height, which branch near the ground and make an abundant growth; leaves small, light green; pods large, very irregular in form and development. The peas are greenish white, of good size, tender and of good flavor, but the pods were not filled.

Saint Duthus, received from Wm. Henry Maule, is one of the best late varieties. The vines are rank, strong growers, with dark green leaves, and are very prolific; pods long, pointed at the apex, well filled with tender, sweet peas. The length of its edible maturity is also a desirable feature.

Class II.—Half Dwarf, two or three feet high; seeds smooth or wrinkled, green or cream colored; pods nearly straight.

C. P. R.—Bruce, is very rank and coarse in growth, and showed traces of mildew this year. The pods are long and pointed at both ends, but were not well filled. Peas are of the marrow type, plump, tender and of the best quality. If it were more productive, it would be a valuable sort.

Table of varieties.

Variety.	Seedsman.	Per cent grew.	Date.		No. of days from planting to edible maturity.	Length of edible maturity.—Days.	No. of peas per pod.	Per cent peas to total weight.	Height of Vines—inches.
			First blossom.	Edible maturity.					
Acme	Wood & Sons	85	June 16	July 10	55	6	6 8	29	24
Admiral	Buckbee	50	“ 24	“ 6	51	8	6 9	37.5	26
Admiral	Ferry	75	“ 24	“ 6	51	8	6 9	44.4	26
Advancer	Ferry	60	“ 16	“ 2	47	8	4 8	50	16
Alaska	Ferry	90	“ 10	June 20	35	8	6 8	29	22
Ameer	Dreer	90	“ 12	“ 30	45	9	4 9	20	19
American Wonder	Ferry	65	“ 10	July 1	46	12	6 8	55.6	12
Anticipation	Sunset Seed Co.	90	“ 25	“ 10	55	10	5 8	37.5	30
Bergen Fleetwing	Gregory	84	“ 12	June 24	39	8	4 7	43	29
Bishop's Dwarf	Landreth	80	“ 24	July 18	63	7	5 8	50	24
Blue Beauty	Bruce	85	“ 13	June 30	45	8	6 8	40.4	22
Champion of England	Ferry	92	“ 28	July 21	66	12	5 7	52	48
Chelsea	Henderson	95	“ 14	“ 1	46	9	5 8	50	29
Clipper	Rawson	90	“ 13	June 26	41	8	4 7	40	20
C. P. R.	Bruce	75	“ 29	July 20	65	12	4 6	36	33
Dexter	Rawson	85	“ 10	June 28	43	10	6 8	40	30
Duke of York	Dreer	68	“ 14	“ 29	44	9	4 9	36	32
Earliest and Best	Salzer	90	“ 11	“ 23	38	7	5 8	40	31
Electric	Dreer	84	“ 14	“ 25	40	8	4 8	37.5	27
English Wonder	Vick	80	“ 20	July 15	60	9	4 7	64	14
Extra Early	Wood & Sons	75	“ 11	June 21	36	8	4 7	50	28
Extra Early Market	Thorburn	60	“ 11	“ 21	36	8	6 9	44.4	34
Family Garden	Maule	92	“ 12	“ 25	40	12	6 9	50	32
First and Best	Ferry	95	“ 10	“ 20	35	10	5 8	50	41
Forty Fold	Landreth	60	“ 28	July 8	53	10	6 9	48	40
Gradus	Burpee	70	“ 16	June 28	43	12	4 7	33.3	32
Hancock	Wood & Sons	60	“ 14	“ 28	43	8	4 8	40	27
John Bull	Thorburn	40	“ 27	July 13	58	10	4 7	33	24
Juno	Henderson	45	“ 27	“ 12	57	10	4 7	56	28
King	Vick	85	“ 16	“ 4	49	12	4 8	50	14
Lightning	Sunset Seed Co.	70	“ 13	June 24	39	8	4 7	43	23
Lightning Express	Beckbee	65	“ 12	“ 26	41	8	4 7	50	32
Long Island Mammoth	Dreer	60	“ 28	July 18	63	12	4 9	27.3	44
May	Salzer	40	“ 14	June 29	44	10	5 7	63.5	16
Mammoth Luscious	Maule	80	“ 28	July 18	63	12	4 6	30.5	48
Michælmas	Sunset Seed Co.	25	July 8	“ 20	65	12	2 4	22.4	21
New Maud S.	Buckbee	55	June 15	June 23	38	10	4 6	50	26
Nott's Excelsior	Ferry	70	“ 15	“ 26	41	10	5 7	55.5	13
Omega	Sunset Seed Co.	80	“ 28	July 8	53	8	4 8	45	28
Perfect	Burpee	20	“ 28	“ 18	63	10	4 8	42	21
Perpetual	Maule	40	July 6	“ 21	66	8	4 6	48.2	30
Philadelphia	Wood & Sons	60	June 14	June 26	41	9	4 6	44.4	27
Pride of the Market	Everitt	60	“ 26	July 12	57	12	3 5	36	22
Prize	Gregory	65	“ 16	June 28	43	10	4 7	50	16
Record	Johnson & Stokes	65	“ 14	“ 26	41	8	5 7	40	33
Reliance	Everitt	55	“ 15	“ 27	42	8	4 7	44.4	24
Ringleader	Bruce	60	“ 12	“ 27	42	9	3 6	40	32
Rural New Yorker	Wood & Sons	50	“ 16	“ 28	43	10	3 5	37.5	27
Saint Duthus	Burpee	75	July 6	July 20	65	12	5 10	51.3	46
Sanders Marrow	Thorburn	10	“ 4	“ 21	66	12	4 5	23.6	29
Scorcher	Salzer	90	June 11	June 25	40	8	4 6	37.5	30
Startler	Buckbee	1	“ 28	July 21	66	10	2 4	18.6	23
Station	Gregory	80	“ 13	June 26	41	10	3 5	50	31
Stratagem	Ferry	20	July 2	July 18	63	12	5 7	53	33
Summit	Northrup, King & Co	75	June 15	June 27	42	12	4 7	37.5	30
Surprise	Gregory	35	“ 16	“ 25	40	8	5 6	43	21
Sweet Market	Vaughan	70	“ 27	July 10	55	10	5 7	52	30
Universal	Childs	30	“ 15	June 29	44	8	4 6	50	8
William Hurst	Bruce	70	“ 16	July 8	53	8	3 5	44.4	8

Dexter, from Rawson, is a straight podded, rank growing variety. The pods are well filled with plump, sweet peas, and, as it is also quite productive, it is a desirable variety.

Duke of York, from Dreer, is claimed to be a selection from the Duke of Albany. The vines are coarse, upright growers, densely covered with light colored foliage. Pods numerous, pointed, straight, and fairly well filled with tender, rich peas. As they mature at one time, it is a desirable variety for the market garden.

Earliest and Best, Salzer, is an upright grower, with vines branching near the ground; foliage thick, light colored; pods numerous, straight and well filled with large, tender, sweet peas.

Electric, from Dreer, resembles Earliest and Best in growth, but lacks in productiveness. The quality is good.

Family Garden, sent out by Wm. Henry Maule, is a good growing variety, very prolific and produced peas of the highest quality. No mistake will be made in sowing this variety.

Gradus, W. A. Burpee. Vines are of a strong habit, branching, with light green foliage; pods nearly straight, pointed, almost round. The peas are large, tender, sweet, and remain in edible condition a long time. This promises to be a valuable acquisition.

John Bull, from Thorburn, is an old standard variety of good quality and average productiveness.

Juno, one of Peter Henderson & Co.'s varieties, is desirable for the main crop. The vines are of dark colored rank growth, and averaging about two feet in height. They branch low and do not require support; pods nearly round, slightly curved and well filled with tender peas of excellent flavor.

Michaelmas, Sunset Seed Co., belongs to this class. The vines mildewed badly, which checked their growth; otherwise they seemed to be good growers, and have large pods, filled with peas of good quality .

Sanders Morrow, Thorburn.—The vines are light green in color and quite productive. Pods long, pointed; peas large, tender. This variety showed blossoms and edible peas at the same time, and had a long edible period.

Class III.—Half Dwarf, two or three feet high; peas blue, wrinkled or smooth; pods straight.

Acme, T. W. Wood & Sons, lacks a little in productiveness. The vines are vigorous and produced a fair amount of pods that were well filled with plump peas of good flavor.

Anticipation, Sunset Seed Co., is a low branching, coarse growing variety, which matures very evenly. It is quite productive and in quality is up to the standard of its class.

Bishops Dwarf, Landreth, is an old variety of good quality, but its short length of edible maturity prevents its becoming one of the standard sorts.

Extra Early Market, J. M. Thorburn & Co., has light green foliage. It is quite prolific, and matures evenly, which together with its good quality, makes it a desirable sort.

Lightning Express, Buckbee, is a good growing variety, and produced an abundant crop of pods well filled with peas of high quality.

Omega, Perfect, Perpetual, Philadelphia, Record, Reliance, Ringleader, Startler, Summit and Sweet Market resemble each other in habit, and their quality is up to the average of their class.

Class IV.—Vines dwarf, one-half to two feet high; pods straight or slightly curved; peas cream or bluish.

The well-known American Wonder is a type of this class, and is valuable either for home use or market.

Ameer, English Wonder, King, May and Prize are worthy of special notice, and will be valuable additions to the standard varieties.

POTATOES.

The land used for the experimental plot during the past season is located on the the north side of the vegetable garden. The soil is a sand loam, very rich in vegetable humus. The ground had been used several years in growing strawberries, and after the fruiting season of 1897 had passed it was plowed, well worked down and about the middle of August seeded to crimson clover, which made a very dense, rank growth, reaching a height of eight to ten inches before the ground froze.

As soon as the ground was in proper condition the following spring, it was plowed, rolled and harrowed at frequent intervals, until the time of planting. The early varieties were planted May 14, and the late ones June 4. The seed was treated with corrosive sublimate (1-2,000) for one hour, and the crop showed a very small amount of scab. At the time of planting, furrows six inches deep and forty-two inches apart were made and each variety was given a space in the row forty feet long. Two pounds of each variety was used for seed and was cut into twenty-five pieces, which were dropped eighteen inches apart. The seed was coverd with a hoe, after which the ground was rolled with a heavy roller to pack the soil. To prevent the evaporation of moisture from the soil and hinder the growth of small weeds, a weeder was used at intervals of four to six days until the plants were about five inches high, after which a Planet, Jr., cultivator was used, strictly adhering to level culture. Both early and late varieties were watered by the irrigating system about the time of setting and once when the tubers were half grown. The season was very favorable for the growth of the plants, and as they were not killed by frost until the middle of October, many varieties continued to grow, even though the tubers reached edible maturity earlier in the season.

Table of varieties, plot planted May 14.

Early varieties.	Seedsman.	Height and color of vines.	Date of maturity.		Yield per acre, bushels.			Average yield for 1897 and 1898.	General average.	Number of years averaged.
		Inches. L. G. (light green.) D. G. (dark green.)	Edible.	Market.	Large.	Small.	Total.			
Acme	Dep't	18..L. G.	Aug. 1	Aug. 13	72.56	10.36	82.92	106.25	125.25	3
Algoma	"	16..L. G.	" 6	" 18	49.24	33.69	82.93	90.61	90.61	2
Andes	"	18..L. G.	July 26	" 10	121.81	2.59	124.4	99.77	99.77	2
Belle	"	18..D. G.	Aug. 6	" 16	75.15	18.14	93.29	137.35	148.59	3
Blush	"	16..D. G.	" 1	" 14	204.74	7.77	212.51	152.9	152.9	2
Bovee	"	18..L. G.	" 3	" 13	88.11	23.32	111.43	138.65	167.18	4
Dawn	H. C. Marsh.	15..L. G.	" 1	" 15	72.56	10.36	82.92	......	......	1
Delaware	Gregory	18..L. G.	" 26	Sep. 15	308.40	10.36	318.76	......	......	1
Garfield	Landreth	20..L. G.	" 26	" 15	308.40	12.95	321.35	......	......	1
Herrington Peer	Dep't	20..L. G.	" 16	Aug. 28	277.30	12.95	290.25	295.44	295.44	2
Honeoye Rose	"	24..D. G.	" 10	" 18	150.31	15.55	165.86	146.42	126.98	3
Hurst	H. C. Marsh.	12..L. G.	" 8	" 20	191.78	5.18	196.96	......	......	1
Irish Cobbler	Dep't	18..L. G.	" 6	" 14	145.13	20 73	165.86	202.14	201.4	3
Kansas	"	18..D. G.	" 1	" 16	152.91	10.36	163.27	161.77	......	2
King of the Earlies	"	15..L. G.	" 6	" 17	44.05	15.55	59.6	68.67	107.51	4
Michigan	"	18..L. G.	July 28	" 10	165.86	10.36	176.22	158.09	148.35	3
Montana Rose	Northrup, King & Co.	20..D. G.	Aug. 1	" 20	150.31	10.36	160.67	......	......	1
Norther	Dep't	22..L. G.	" 6	" 15	191.78	12.95	204.73	184.00	186.92	3
Ohio	E. Tully	20..D. G.	" 1	" 10	150.31	5.18	155.49	......	......	1
Peachblow	Dep't	22..D. G.	" 1	" 20	119.21	5.18	124.39	143.83	192.27	4
Pinkeye	"	18..L. G.	July 28	" 14	77.75	15.55	93.3,	123.1	134.76	3
Pride	"	18..D. G.	Aug. 6	" 18	75.15	10.36	85.52	103.66	127.84	3
Quick Crop	"	18..L. G.	" 1	" 10	114.03	18.14	132.17	112.73	128.37	3
Read 86	"	22..D. G.	" 6	" 22	93.3	12.95	106.25	97.18	123.57	4
Richmond Belle	Wood & Sons	24..D. G.	" 1	" 16	243.61	......	243.61	......	......	1
Roberts	Gregory	18..L. G.	" 6	" 12	176.23	10.36	186.59	......	......	1
Six Weeks	Dep't	24..D. G.	" 2	" 12	176.23	7.77	184	88.24	......	2
Snowball	"	20..D. G.	July 28	" 10	124.4	2.59	126.99	126.98	......	2
Snowflake Jr.	"	20 Purple	Aug. 1	" 13	287.67	2.59	290.26	248.13	222.85	5
State of Maine	Landreth	22..L. G.	" 1	" 14	116.62	10.36	126.98	......	......	1
Thoroughbred	Dep't	18..L. G.	" 1	" 13	165.86	18.14	184.	141.24	138.22	3
Trumbull	"	20..L. G.	" 6	" 19	139.95	12.95	152.9	119.21	......	2
White Lily	"	18..L. G.	" 6	" 20	88.11	25.91	114.02	112.73	132.23	4
" Ohio	"	15..L. G.	" 6	" 16	132.17	5.18	137.35	108.84	......	2
Woodhull	"	24..L. G.	" 16	" 24	178.82	25.91	204.73	222.82	......	2
Wood's Earliest	Wood & Sons	18..D. G.	July 28	" 8	72.56	5.18	77.74	......	......	1

Table of varieties, plot planted June 4.

Late varieties.	Seedsman.	Height and color of vines.	Date of maturity.		Yield per acre, bushels.			Average yield for 1897 and 1898.	General average.	No. of years averaged.
		Inches. L. G. (light green.) D. G. (dark green.)	Edible.	Market.	Large.	Small.	Total.			
Abundance	Dep't	24..L. G.	Sep. 10	Sep. 28	191.78	20.73	212.51	186.59	219.42	3
Accidental	"	27..D. G.	" 6	" 18	160.68	-----	160.68	181.7	...	2
Adirondac	"	21..L. G.	" 15	" 30	207.33	5.18	212.51	199.55	188.31	3
American Beauty	"	18..L. G.	" 8	" 20	88.11	5.18	93.29	85.37	155.48	3
Arizona	"	24..L. G.	" 1	" 10	155.5	7.77	163.27	136.05	-----	2
Battles' Best	"	28..D. G.	" 20	" 30	331.73	5.18	336.91	243.61	-----	2
Beauty of Beauties	"	26..D. G.	" 16	" 25	290.26	2.59	292.85	126.99	-----	2
Blush	"	24..L. G.	" 4	" 20	119.21	5.18	124.39	121.8	-----	2
Burr No. 1	"	18..L. G.	" 1	" 12	114.03	5.18	119.21	121.8	-----	2
Carman No. 1	"	26..D. G.	" 15	" 28	347.27	2.59	349.86	269.52	220.69	5
Carman No. 3	"	26..D. G.	" 15	" 28	316.18	28.5	344.68	256.56	282.22	4
Champion of the World	"	28..L. G.	" 20	" 29	155.5	7.77	163.27	121.75	231.51	3
Clarendon Beauty	"	24..L. G.	" 24	Oct. 6	233.25	7.77	241.02	159.38	----	2
Clinton	A. F. Currier	28..D. G.	" 8	Sep. 20	248.8	10.36	259.16	-----	-----	1
Columbus	Dep't	30..L. G.	" 18	" 26	253.98	20.73	274.71	216.4	-----	2
Dutton	Chapman	24..L. G.	" 16	" 26	196.96	5.18	202.14	-----	-----	1
Endurance	Dep't	24..D. G.	" 20	Oct. 8	145.13	5.18	150.31	105.13	.	2
Enormous	"	24..L. G.	" 20	Sep. 30	160.68	2.59	163.27	165.86	290.25	3
Flagle	"	24..D. G.	" 20	" 28	248.8	5.18	253.98	168.45	202.14	3
Fottler Peachblow	"	26..D. G.	" 26	Oct. 8	176.23	5.18	181.41	147.72	218.45	3
General Purpose	"	24..L. G.	" 12	Sep. 20	57.01	7.77	64.78	93.29	169.31	3
Good Times	"	26..D. G.	" 14	" 26	285.08	5.18	290.26	233.24	....	2
Harvest Queen	"	26..L. G.	" 20	" 30	217.7	7.77	225.47	171.04	228.06	3
Hewes	Vaughan	21..L. G.	Aug. 24	" 6	111.44	2.59	114.03	-----	-----	1
Honeoye Rose	Dep't	20..L. G.	" 22	" 2	116.62	36.28	152.9	133.46	118.34	3
Hoosier	B. W. Steere	10..L. G.	Sep. 4	" 16	-----	5.18	5.18	-----	-----	1
Irish Mignon	Dep't	24..D. G.	" 10	" 24	121.81	10.36	132.17	110.14	-----	2
Joseph	"	26..L. G.	" 20	Oct. 4	243.61	23.32	266.93	187.7	-----	2
King of the Roses	"	24..L. G.	" 1	Sep. 10	129.58	46.65	176.23	132.17	141.73	3
Klondyke	"	26..L. G.	" 10	" 18	186.6	36.28	222.88	2 7.69	-----	2
Leonard	"	28..D. G.	" 18	" 30	313.58	31.1	344.68	224.17	.	2
Lightning Express	"	26..D. G.	" 4	" 18	222.88	25.91	248.89	181.45	183.57	5
Lincoln	"	30..D. G.	" 20	" 28	222.88	31.1	253.98	207.32	-----	2
Livingston	Livingston	26..D. G.	" 20	" 29	347.27	31.1	378.38	-----	-----	1
Livingston Banner	Dep't	24..D. G.	" 16	" 24	310.99	10.36	321.35	233.23	298.03	3
Long Keeper	"	24..L. G.	" 24	" 30	129.58	7.77	137.35	149.01	-----	2
Maggie Murphy	"	24..L G.	" 12	" 20	145.13	28.5	173.63	169.74	233.37	3
Maule XXX	Maule	26..D. G.	" 16	" 26	129.58	5.18	134.76		.	1
Michigan Beauty	Dep't	24..L. G.	" 18	" 29	181.41	41.46	222.87	133.46	128.72	3
Mills Banner	"	27..D. G.	" 19	" 29	145.13	28.5	173.63	203.43	-----	2
Mills Prize	"	30..L. G.	" 24	" 30	219.29	67.38	287.67	220.28	..	2
Milwaukee	"	24..L. G.	" 6	" 20	142.54	46.65	189.19	164.56	152.92	5
Minnehaha	E. Tully	18..L. G.	" 2	" 16	121.81	18.14	139.95	-----	-----	1
Montana Wonder	Northrup, King & Co.	26..D. G.	" 20	" 30	134.76	31.1	165.86	-----	-----	1
Napoleon	Dep't	24..D. G.	" 14	" 24	145.13	23.32	168.45	132.67	231.51	3
Onward	"	26..D. G.	" 20	" 28	132.17	67.38	199.55	147.71	-----	2
Orphans	Chapman	25..L. G.	" 20	" 29	331.73	25.91	357.64	-----	-----	1
Padelfords	Dep't	26..L. G.	" 4	" 20	215.1	38.87	253.97	200.42	-----	2
Peachblow	"	24..D. G.	" 28	Oct. 10	233.25	23.32	256.57	193.02	273.84	3
Perfection	"	24..D. G.	" 6	Sep. 18	145.13	41.46	186.59	168.45	-----	2
Pingree	Northrup, King & Co.	26..L. G.	" 20	Oct. 1	215.1	41.46	256.57	-----	-----	1
Planet, Jr.	Dep't	25..L. G.	" 20	Sep. 28	129.58	33.69	163.27	164.56	-----	2
Pride of Michigan	L. L. Olds	21..L. G.	" 2	" 12	98.48	7.77	106.25	-----	-----	1

Table of varieties, plot planted June 4.—CONCLUDED.

Late varieties.	Seedsman.	Height and color of vines. Inches. L. G. (light green.) D. G. (dark green.)	Date of maturity. Edible.	Date of maturity. Market.	Yield per acre, bushels. Large.	Yield per acre, bushels. Small.	Yield per acre, bushels. Total.	Average yield for 1897 and 1898.	General average.	No. of years averaged.
Pride of Seneca......	Dep't..........	24..L. G.	Sep 14	Sep. 26	145.13	25.91	171.04	152.29	......	2
Read 99..............	“	24..D. G.	“ 10	“ 20	116.62	36.28	152.9	143.83	......	2
Rose of Erin..........	“	24..D. G.	“ 16	“ 28	155.5	36.28	191.78	156.79	.....	2
Rose Standish.......	“		“ 16	“ 28	139.95	25.91	165.86	141.22	157.33	3
	“	24..L. G.								
Rural New Yorker..		26..D. G.	“ 20	“ 29	176.23	20.73	196.96	178.82	192.32	9
Rutland Rose.......	“	18..L. G.	“ 18	“ 28	56.6	25.91	85.51	99.77	209.05	3
Seedling No. 2.......	“	26..L. G.	“ 20	“ 28	111.44	7.77	119.21	95.88	......	2
Sir Walter Raleigh.	“		“ 24	Oct. 4	165.86	25.91	191.77	172.33	......	2
		24..D. G.								
Suffolk Beauty......	“	22..L. G.	“ 24	“ 6	155.5	10.36	165.86	154.19	......	2
Taylor	Taylor	26..L. G.	“ 10	Sep. 30	196.96	20.73	217.77	......	......	1
Uncle Sam..........	Dep't	24..D. G.	“ 22	“ 30	106.25	15.55	121.8	148.01	142.53	3
Unknown............	“		“ 26	Oct. 10	212.51	12.95	225.46	156.78	139.05	3
		26..L. G.								
Vanguard............	“	24..D. G.	“ 18	Sep. 30	202.15	......	202.15	145.13	217.57	5
Venezuela	Pingree.......	18..D. G.	“ 20	“ 28	75.15	15.55	90.7	.....	......	1
Vigorosa	Dep't	24..L. G.	“ 16	“ 24	176.23	31.1	207.33	186.59	165.19	3
White Peachblow...	“	26..D. G.	“ 28	Oct. 10	225.47	28.5	253.97	117.72	.....	2
Wonderful...........	Hammond...	24..L. G.	“ 24	Sep. 30	155.5	5.18	160.68	.....	....	1

The Colorado potato beetles were very numerous in the early part of the season, which made it necessary to spray the vines often; but the late varieties were sprayed only when they were about four inches high and when half grown. For this purpose white arsenic instead of Paris green was used with good results. Great care, however, must be taken in the use of arsenic, or the foliage will be injured. It should be prepared as follows: For one pound of arsenic, take two pounds of unslaked lime, and two gallons of water. Slake the lime in the water and heat until it comes to the boiling point; then add the arsenic and let it boil slowly for thirty minues. The arsenic will dissolve and unite with the lime, forming an insoluble compound, which can be used without danger of injuring the foliage, at the rate of 200 gallons of water for one pound of arsenic. Bordeaux mixture was also applied to the entire crop as a preventive against leaf blight.

In addition to using the more promising of the varieties tested in 1897, an endeavor was made to secure new varieties from seedsmen and introducers. The addresses of the seedmen from whom the new varieties were received are as follows: T. W. Wood & Sons, Richmond, Va.; J. C. Vaughan, Chicago, Ill.; D. Landreth & Sons, Philadelphia, Pa.; A. W. Livingston's Sons, Columbus, O.; James J. H. Gregory & Son, Marblehead, Mass.; Wm. Henry Maule, Philadelphia, Pa.; H. C. Marsh, Munice, Ind.; Northrup, King & Co., Minneapolis, Minn.; L. L. Olds, Clinton, Wis.; H. N. Hammond, Decatur, Mich.; C. E. Chapman, Peruville, N. Y.; E. Tully, Penza, O.; A. F. Currier, Duplain, Mich.; B. W. Steere, Carthage, Ind.; F. D. Taylor, Traverse City, Mich.

Notes on New Varieties.

Clinton.—A medium late kind which appears to be productive and in every way promising. The vines are dark green, strong growers, branching close to the ground and exceeding two feet in height. The tubers are medium to large in size; in shape, round, or a little elongated and sligthly flattened; skin, clear white, smooth, finely netted and spotted with numerous small dots; eyes, long, broad and shallow, slightly lipped. The texture is firm, white and floury.

Dawn.—An early variety that resembles Early Ohio in growth, but is a little different in form. The vines are also more slender than those of the Ohio. The tubers averaged rather small; shape, long, roundish and tapering, being larger at the stem end; skin, light pink, with small russet and pink patches scattered over the surface. The eyes are of medium depth with strong markings, pinkish, open and shallow, well scattered over the surface; flesh, very firm, solid and white. The yield was light, but owing to its other promising characteristics, it will be given further trial.

Delaware.—A medium early variety that possesses many strong points. The tubers reached edible maturity rather early, but the season was favorable for their growth, and the vines remained green until the late varieties were harvested; the plants are strong, light green, upright growers, and form a compact covering fo the hills. The tubers are roundish or of a somewhat irregular, oblong, flattened form. They were slightly inclined to be knobby, but this, perhaps, was due to the season; skin, white, finely netted; eyes numerous, strong, well distributed, rather open and deep. The flesh is solid, white and fine grained.

Dutton.—Considered a leading market variety in some parts of New York state. Size, medium to large; long, oval, tapering towards the stem. The skin is white and smooth; eyes, narrow, small, shallow with pink markings, and slightly lipped; flesh, white and a little coarse. The vines are strong and thrifty, with a light green tint.

Garfield.—A variety with medium sized, light green vines, that reached edible maturity as soon as many of the early sorts, but continued to grow until late in the season. The potatoes were very regular, oblong and little flattened; eyes, about medium in number, well scattered, small, white, slightly lipped and not very deep; skin, white, finely netted and with slight russet appearance. The flesh is firm, fine grained and very white. This and Delaware are two very promising varieties that closely resemble each other.

Hewes.—A seedling received from Vaughan, the tubers of which though rather small, were very regular, and of a desirable elongated, oval, flattened shape. The skin is creamy white, finely netted and specked with numerous raised dots, or minute pimples, eyes, open, shallow, pink, with strong seed sprouts. The texture and flavor are very desirable, and the markings strongly resembling those of the Early Ohio. Will be given further trial.

Hoosier.—A pinkish-white, smooth-skinned potato, with some desirable characteristics, but the yield was so small that it will be tried again before any description is given.

Hurst.—Vines are of short, but strong, upright growth, and of a light green color. The tubers averaged about medium size, but are not of a desirable shape, being long, pointed at the ends and crooked, which makes them appear necky. The skin is white, finely netted; eyes, shallow, scattering and sometimes raised above the surface. The quality is up to the standard, but the appearance of the potato is against it for a market variety.

Livingston.—A new late variety, originated at Columbus, O., which resembles Seneca Beauty, except in color. The vines are strong upright growers with a thick mass of large dark-green leaves; the tubers average large, rather coarse; shape, oblong, slightly flattened; skin, clear white, netted. The eyes are small, shallow and scattering, and have decided pink markings; flesh, white, firm, but a little coarse. Owing to its excellent growth, size, shape and quality, this variety promises to be among the leaders.

Maule XXX.—An attractive pinkish-white potato, uniformly of large size; shape, long, flattened. The skin has a delicate pink tint, is netted and somewhat veined; eyes, rose-colored, narrow, deep, strongly lipped and with prominent buds. The eyes are evenly distributed over the surface, and one of the leading characteristics seems to be a slight fan-shaped wing, extending from the tip and sometimes from the base of the eye; flesh, white, rather coarse. This variety is a strong grower, and the tubers appear somewhat coarse, while the ridges around the eyes give them a rough appearance.

Minnehaha.—A medium season variety, having short, stocky upright vines. The tubers averaged medium to large in size; shape, long, slightly curved, with oval ends and of uniform size the entire length; skin, clear white, or slightly netted; eyes, small, rather deep, numerous; flesh firm, solid and white. Its cooking qualities are good, but the shape and lack of productiveness prevent its being of special promise.

Montana Rose.—A light rose-colored variety, very uniform in size; shape, flat, oval or somewhat elongated; skin, thickly netted and prominently veined; eyes, small, shallow, located mostly toward the seed end. In texture they appear a little spongy, but the flesh is white and starchy. The vines are dark green, strong growers, of medium height and of branching habit. Although only a small yield was obtained, the other good qualities of the variety will secure for it further trial.

Montana Wonder.—A medium late variety that lacked in productiveness, but has other redeeming qualities. The tubers are large, long, oval, rather irregular; eyes, numerous, well scattered, shallow, many being even with the surface, and with prominent elevated lips, while others are sunken in an irregular pocket, making the tubers appear rough. The skin is white, finely netted, and the quality excellent. The vines are dark green and rank growers.

Ohio.—Mr. E. Tully, of Penza, Ohio, sent a sample of seed for trial, which proved to be a very fine strain, showing that the variety has been kept pure by careful selection, which has probably prevented the usual deterioration, noticeable in this variety. The tubers were large, oval, symmetrical, smooth and of the usual high quality.

Orphans.—Received from Peruville, N. Y., proved to be very choice stock of that variety. The plants were strong and the yield speaks for itself, being considerably larger than was secured from seed grown here for three years. This shows the advisability of occasionally changing the seed. No difference in the quality was noticeable. The tubers are large, regular, oblong, flattened; eyes, few, shallow, well scattered; skin, netted, white; flesh, firm, white and dry.

Pingree.—A very clear, white-skinned potato, free from dots or bunches; shape, slightly oval, with a large seed end tapering to the stem. The eyes are broad, open, shallow, white and scattering; in texture they are very firm and floury. The vines are strong, light green, upright, branching growers.

Pride of Michigan.—The tubers are of good size but rather rough in appearance and with an irregular, oblong shape. The skin is of a delicate pink and white tint, finely netted, and with a smooth, velvety apeparance. The eyes are large with pink markings, open usually on the surface, though some are deeply sunken; quality good; vines of medium size, branching close to the ground. Although lacking in productiveness, and rougher than is desirable, the quality is such that they will be given further trial.

Richmond Belle.—One of the most productive of the early varieties. Size, medium to large; shape, round, to oblong, some being considerably elongated. Tubers all merchantable. The eyes are broad, shallow, pink, few in number and well scattered; very solid, firm and of high quality. This is a promising sort, and while it resembles the old variety, Early Belle, it seems to be a stronger grower.

Roberts.—Said to be a sport from Queen, but differs in color, having a clear white netted skin. The tubers averaged rather small, oval, slightly flattened; eyes, shallow, small, with pink markings; quality good, being firm, dry and of good flavor. It is considerably advertised as a choice, early sort, but our trial for one year does not enable us to pronounce it superior to many others.

State of Maine.—In form, round and regular, with a white, netted skin. The eyes are small, round and shallow, with fan-shaped extensions from the edges of the lip; flesh, firm and dry, but a little strong. A strong growing, early sort, but it lacks in productiveness.

Taylor.—A sport of Hebron, which gave a good yield of desirable tubers. They are large, oblong, a little flattened and with a tendency to taper toward the ends; skin, clear, white, slightly netted; eyes, narrow, small, deep, prominently lipped, and well distributed, although a majority are toward the seed end; flesh, white, dry and floury. Taylor is a little later than Hebron and has coarser vines, which average over two feet high, and branch close to the ground.

Venezuela.—A potato brought from the country of that name, by Governor H. S. Pingree, the seed of which was received here October 15, 1897. The tubers were in a poor state of preservation and at the time of planting, many were badly decayed, which had a tendency to weaken the eyes. The plants however, made a fair growth and developed a strong, medium sized vine. The tubers were of average size, long, pointed, rather irregular, somewhat flattened; skin, smooth, dark purple, with occasional white spots; eyes, broad, very deep, and dark purple. They resemble Early Rose in form, but the color is such that they would not become a market variety, even if they were up to the average in productiveness.

Wood's Earliest.—One of the first to mature, but lacking in productiveness. The tubers were medium to large; shape, irregular, round to oblong; skin, pure white, with occasional small patches of purple; eyes, strong, deep, purple, lipped very much like Peachblow, scattered evenly over the surface. The flesh is pure white and firm, but it seems to be a little watery.

Wonderful.—A long, rather coarse, oval potato, having a white, finely netted skin. The eyes are broad, open and of medium depth, giving them a smooth appearance; flesh firm, white and watery; vines are strong growers, but the yield was unsatisfactory.

Summary.

The yields this season show a decided increase over those of 1898.

Thirty-one varieties last year planted May 11, averaged 130.1 bushels per acre; this year thirty-six varieties planted May 14, showed a yield of 159.5 bushels, an increase of 29.4 bushels per acre.

The seventy-one sorts planted June 4, averaged 201.24 bushels per acre, while seventy-five planted June 4, 1897, only averaged 124.88 bushels per acre, or a difference of 73.36 bushels in favor of the crop of 1898.

The soil for the two tests was very similar, but the summer of 1898 was a month longer and more favorable for large yields, although in some instances it was detrimental to the quality of the tubers.

Among the more promising of the new extra early varieties, maturing in July, is Andes, which gave a yield of 124.4 bushels, and was fully ripe July 26, although the tubers were merchantable a week or ten days earlier. Early Michigan, a choice, smooth, white potato, ripened only two days later and gave a yield of 176.22 bushels. Snowball, a round, white variety, gave 126.99 bushels per acre.

Of those maturing about August 1, or less than a week after Andes, is Snowflake, Jr., which yielded at the rate of 290.26 bushels per acre. It is an oblong, smooth potato, of high quality, that has been grown here for five years, and for that period has averaged more than 200 bushels per acre. Richmond Belle comes next (243.61 bushels), followed by Blush (212.51 bushels) and Kansas (163.27 bushels), both of which are of standard quality. Norther (204.73 bushels), a variety of the Rose type, has been grown for six years, and is one of the best second early sorts, ripening about a week after Early Michigan.

Medium Varieties.

Of the medium varieties, Garfield (321.35 bushels) and Delaware (318.76 bushels) gave the largest yields. Herrington Peer (290.25 bushels) matured a few days earlier, but did not quite reach its yield of last year. It is a seedling of Early Rose and the two are nearly identical, but the quality of the Peer is superior. Last season it yielded at the rate of 300.62 bushels per acre.

The season was very favorable for the maturing of the late varieties, some of the later kinds being still green and uncut by frost when they were harvested, about the middle of October.

Livingston (378.38 bushels) gave the largest yield, but Leonard (344.68 bushels), Battles' Best (336.91 bushels), Livingston Banner (321.35 bushels) and Orphans (337.64 bushels) are heavy croppers, of good quality and promise to become standard varieties.

Carman No. 1 (349.86 bushels) and Carman No. 3 (344.68 bushels) raised their average, and still stand as leaders among the commercial varieties. The latter is, as a rule, rather more productive than Carman No. 1, and in many sections is being extensively planted in place of Rural New Yorker.

The Prevention of Potato Scab.

During the last two seasons, tests have been made of various materials as preventives of the scab upon potatoes. The ground selected had not been used for growing potatoes for several years, hence the soil should have been free from the scab germs. The variety used for the experiment was Carman No. 3, and in selecting the tubers, special pains were taken to have more or less scab upon each of the tubers. The remedies and methods of applying them were as follows: (1) Chloride of lime sprinkled upon the seed dry, after it was dropped. (2) Chloride of lime as a 5% solution in which the seed was soaked for three hours. (2) Formaldehyde gas to which three lots of seed were exposed for two, five and seven hours, respectively. (4) One-half per cent formalin, in which five lots of seed were soaked two, four, six, ten and twenty-four hours, respectively. (5) Lysol, one-half per cent, in which different lots were treated two, four, six and ten hours. (6) Carbolic acid, two per cent solution, in which four lots were soaked for two, four, six and ten hours. (7)

Chlorine gas, to which the seed was exposed for three hours in a tight receptacle. (8) Corrosive sublimate, at the rate of one part to two thousand of water, in which the seed was soaked for one-half hour.

Rows forty feet long were planted with seed that had been treated in each of the above ways, and four additional rows were planted with seed that had not been treated as a check. A record was kept of the number that grew with each of the treatments, and when the crop was harvested, the per cent of tubers that were scabbed was determined. The results are given in the following table, with the cost of each treatment for one acre of potatoes:

Scab Experiment.

Material Used.	Manner of Application.	Per cent of Plants that Grew.	Per cent of Potatoes Scabbed.	Cost of Material per acre, cents.
Chloride of lime in the hills	Sprinkled on the seed dry	10	0	50
Chloride of lime 5% solution	Soaked seed 3 hours	75	10	32
Formaldehyde gas	In closed receptacle 2 hrs.	25	1	6
“ “	“ “ 5 “	0	0	6
“ “	“ “ 7 “	0	0	6
Formalin solution ½%	Soaked seed 2 hours	98	2	10
“ “ “	“ “ 4 “	35	1	10
“ “ “	“ “ 6 “	30	1	10
“ “ “	“ “ 10 “	8	0	10
“ “ “	“ “ 24 “	4	0	10
Lysol solution ½%	Soaked seed 2 hours	60	2	20
“ “ “	“ “ 4 “	48	1	20
“ “ “	“ “ 6 “	35	0	20
“ “ “	“ “ 10 “	7	0	20
Carbolic acid solution 2%	Soaked seed 2 hours	0	0	55
“ “ “ “	“ “ 4 “	0	0	55
“ “ “ “	“ “ 6 “	0	0	55
“ “ “ “	“ “ 10 “	0	0	55
Chlorine gas	In tight receptacle 3 hours	20	1	10
Corrosive sublimate (1-2000)	Soaked seed ½ hour	100	2	4
Nothing		100	10	0

It will be noticed that the five per cent solution of chloride of lime destroyed 25 per cent of the seed but produced no effect on the amount of scab upon those that grew. When used dry in the hills, the injury was less severe, but only 10 per cent of the plants grew. The result, so far as the prevention of scab was concerned, seemed to be satisfactory, as all of the tubers were smooth. Formaldehyde gas also had an injurious effect upon the development of the seed, as after being treated with the gas in a closed receptacle for two hours, three-fourths of the seed failed to grow, and the plants that did develop were quite weak and spindling, and very few of the tubers were merchantable. The gas, however, seemed to be effective in preventing the scab, as only one per cent were scab affected, while the untreated rows averaged 10 per cent. In the rows where the seed had been treated five and seven hours with formaldehyde gas, no plants appeared. One-half per cent formalin also seemed to have an injurious effect upon the development, as when seed was soaked for two hours a slight injury was noticed, and after twenty-four hours, only four per cent grew. A small amount of scab was found where the treatment ranged from two to six hours, but with the longer treatments no scab was apparent. The results with a one-half per cent solution of lysol were similar to those secured with formalin, except that the injurious effect upon the seed was more marked. When the two per cent solution of carbolic acid was used, none of the plants grew, and with chlorine gas, only twenty per cent of the plants grew, but the plants that did develop showed only slight traces of scab. Corrosive sublimate at the rate of one to two thousand and with the seed soaked one-half hour, seemed to have no injurious effect upon the growth of the plants, and reduced the per cent of scabbed tubers to two, as compared with ten where the seed was untreated.

As will be noticed in the column giving the cost of materials per acre, the corrosive sublimate treatment is cheapest of all, although the cost of the formalin treatment is not excessive. With the use of these materials, taking two hours as the maximum time for the treatment of the seed with formalin, the results seem satisfactory, and in sections where the crop is seriously affected with the scab, the use of either of them will be found profitable. As every one of the other treatments resulted in injury to the seed and partial or total loss of the crop, they cannot be recommended, especially as most of them are considerably more expensive than either formalin or corrosive sublimate. From the fact that corrosive sublimate is a poison, many have hesitated to use it, but as it can generally be secured at any drug store, while formalin can be found, as a rule, only in the larger towns, the former will undoubtedly be quite generally used. Corrosive sublimate can usually be obtained for eight or ten cents an ounce, and at about one-half this price in larger quantities, while formalin costs about fifty cents per pound. Experiments with the use of corrosive sublimate for the prevention of potato scab have now been carried on for five or six years, and the method of preparing and using it has several times been given, but as we have frequent inquiries regarding it, the directions are repeated.

The treatment should be made in a wooden vessel of some kind, and metal receptacles should always be avoided. For sixteen gallons of water take one ounce of corrosive sublimate, which should be moistened and made into a paste and dissolved in one gallon of boiling water before it is diluted. Fairly good results are secured when the seed, without previous preparation, is placed in this solution and allowed to remain from thirty to sixty minutes, but in case the seed is badly infected with the scab, it is advisable to soak it in clear water for one or two hours before placing it in the corrosive sublimate solution. The treatment is often given after the seed has been cut, but as the exposed flesh of the tubers is slightly injured by the treatment, it is advisable to soak the seed before cutting the tubers. Unless to be used within a day or two, care should be taken not to allow the tubers to remain in a deep pile, and in no case should they be placed in bins, boxes or bags in which potatoes have been stored, unless care is taken to disinfect these with the corrosive sublimate solution. One ounce of the corrosive sublimate will be sufficient for ten bushels of the seed, but as the strength of the solution is gradually reduced, it is advisable to add one-half ounce of the corrosive sublimate after treating five bushels and repeat this until all have been treated.

The aid given by the bacteriologist, Prof. C. L. Marshall, in the way of advice and assistance in making the treatments, as well as the deep interest taken by him in the results, is greatly appreciated.

Several investigators have reported marked benefits from the use of sulphur as a preventive of potato scab, but our own tests do not justify this claim. As long ago as 1889, when the use of this material was first advocated, we made a thorough test of sulphur, using it at the rate of one hundred and fifty pounds per acre upon two varieties. When the tubers were dug many of them were coated with sulphur, but little if any benefit could be observed and, in one case, there were rather more scabby tubers where the sulphur had been used, than where the seed was planted without treatment. As a result of this experiment we have little faith in the efficacy of sulphur. As compared with corrosive sublimate, the particular claim that has been made for sulphur is that it is not poisonous, while a very small amount of corrosive sublimate would prove fatal to animals of any kind, but, even when sulphur is used at the rate of only one hundred and fifty pounds per acre, the cost would be so great that few would be likely to adopt it as a remedy, especially as corrosive sublimate for treating the seed for an acre of potatoes does not cost more than five cents, and if ordinary care is taken, there will be no danger from its use.

Co-operative Experiments with Potatoes.

For several years we have sent out a number of collections of the varieties that seemed most promising to thirty or forty persons in various parts of the state, in order that the varieties might be tested under varying conditions of soil and climate. We also aimed to thus distribute the new kinds, as the recipients were asked t share their first year's crop with their neighbors. In order that the reports might furnish similar data, blanks were sent with the seed on which the following points were to be noted: Date of planting, date of ripening, the distance of planting, the number of hills, the yield both of large and small, and the size and quality of the tubers. We give below the average of the reports we have received and readers can draw their conclusions as to the varieties likely to be of value in their section.

In order that the seed might be furnished to some of the representative farmers of each county, it was distributed through the secretaries of the various county institute societies, and it is understood that a report upon the varieties and an exhibition of the tubers will be made at the winter institutes.

The collections consisted of two pounds of about ten different varieties, the majority of which were comparatively new sorts, although some of the older standard kinds were included for comparison.

About fifty collections were sent out during April, 1898, and reports have been received from a majority of the parties, including:

Geo. W. Abbot, Alma.
F. A. Bradley, Vassar.
C. E. Crissman, Washington.
H. H. Doane, Barron.
Freeman Franklin, Buchanan.
Walter Gorton, Howell.
John M. Haven, Bloomingdale.
Joseph Long, Bad Axe.
H. A. Nichols, Hastings.
James Russell, Creswell.
W. C. Stewart, Fremont.
Parley C. Thomas, Hemlock.
Mark Turner, Huron.
Chris Bernhart, Beechwood.
Robert Brighton, Wyandotte.
H. C. Dennison, Ada.
E. E. Evans, Edward.
F. E. Goodspeed, Ithaca.
Wm. H. Gorsline, Battle Creek.
C. S. King, Thornton.
John F. Muller, Wayne.
O. A. Nummer, Ionia.
Alonzo Stitson, Walled Lake.
Fred A. Thatcher, Ravenna.
O. S. Thompson, Allen.
Frank Ward, Vermontville.
Dell Warren, Stanwood.

An average was taken from the reports of the above, which showed the following yields per acre in bushels:

Variety.	*Marketable.*	*Unmarketable.*	*Total.*
Abundance	241.95	24.5	236.45
Carman No. 1	251.2	21.3	272.5
Carman No. 3	248.7	14.7	263.4
Early Michigan	152.3	23.4	175.7
Early Norther	185.7	28.4	214.1
Early Peachblow	186.3	14.7	201.0
Early Thoroughbred	167.1	28.1	195.2
Livingston Banner	170.3	12.7	183.0
Maggie Murphy	181.4	17.2	198.6
Peachblow Seedling	280.	25.	305.
Rose No. 9	221.7	16.	237.7
Rose Standish	150.3	17.3	167.6

RADISHES.

The forcing radishes are small in size and of quick maturity. The form differs from round-turnip to olive-shaped or half-long tapering; the color from white or yellow to all shades of red, scarlet and crimson. Many sorts differing in name are almost identical, though usually slight differences in form or color distinguish the varieties.

Varieties having Round or Turnip-shaped Roots.

Earliest.—From D. Landreth & Sons. Tops small; root very dark garnet color; flesh greenish white, crisp and tender. The variety has a long season, but the very dark color is somewhat unattractive.

In and Out.—An excellent bright, dark red sort with white tips.

Leafless.—From J. J. H. Gregory, Marblehead, Mass. The tops are very small and a dark green color. The root is dark red, handsome in appearance, regular in form, and mild and pleasant in flavor. Unique in smallness of tops.

Ruby Pearl.—From W. Atlee Burpee & Co. A very fine bright red sort. Perhaps the best of the turnip class grown here this season.

Twenty Day Forcing.—From Johnson & Stokes. A very fine round sort with a slender white tap-root. Very attractive in appearance; crisp and of mild flavor.

White Rocket, White Summer Turnip and White Turnip Rooted are fine white sorts, mild and pleasant in quality. They are not so attractive as the bright colored varieties.

Table of varieties.

Variety.	Seedsman.	Days to edible maturity.
All Seasons	Jas. Vick's Sons	29
Cardinal	W. H. Maule & Co.	25
Cincinnati Market	J. C. Vaughan	32
Eighteen Day Forcing	J. A. Salzer	24
Earliest	D. Landreth & Sons	25
Erfurt	J. A. Salzer	29
French Breakfast	D. M. Ferry & Co.	25
Gray Summer	D. M. Ferry & Co.	36
In and Out	J. A. Bruce & Co.	26
Leafless	J. J. H. Gregory	28
Lily White Turnip	J. A. Bruce & Co.	29
Long Scarlet Short Top	D. Landreth & Sons	35
Number Seventy-nine	H. W. Buckbee	30
Red Rocket	Peter Henderson & Co.	26
Rose	D. M. Ferry & Co.	27
Ruby Pearl	W. A. Burpee & Co.	26
Strasburg	D. M. Ferry & Co.	34
Twenty Day Express	J. Lewis Childs	24
Twenty Day Forcing	Johnson & Stokes	28
White Globe Forcing	H. A. Dreer	29
White Naples	D. M. Ferry & Co.	36
White Rocket	Peter Henderson & Co.	29
White Tipped Rocket	Peter Henderson & Co.	24
White Summer Turnip	D. M. Ferry & Co	31
White Turnip Rooted	D. M. Ferry & Co.	30
Yellow Summer Turnip Rooted	D. M. Ferry & Co.	32

Of the varieties belonging to the olive-shaped class, Red Rocket and Rose gave the best satisfaction.

Cardinal and Eighteen Day Forcing have roots three to four inches long and one inch in diameter at base. Their bright red color is very attractive and their larger size and quick maturity make them preferable to the smaller sorts for forcing or outdoor planting.

Long Scarlet Short Top and Cincinnati Market are long rooted sorts well suited to the outdoor kitchen garden or for market purposes.

SWEET CORN.

The trial plot of sweet corn was planted May 26. Thirty-one varieties, including many of the old sorts and some new ones which have not been described in our bulletins, were used: Adams, White Cory, Champion, Concord, Country Gentleman and Stowell's Evergreen are varieties that are familiar to most growers and need no further description.

Asylum, one of Vaughan's medium varieties, was not entirely satisfactory, but will be given further trial, as it has good-sized, well covered ears. The kernels were plump, broad, cream white, tender and quite sweet for an early sort.

Best of All, from Buckbee, is very much like White Cory, but it is somewhat later The ears were of good size for eight-rowed corn, and well covered with broad, tender kernels of good length; cob small and white.

Beverly, from Landreth, was among the best early sorts. The ears were of only medium size, but they were well covered. The quality of the kernels, for corn of its season, is very good, and, though it lacked in the size of its ears, the delicious flavor makes it a desirable sort.

Early Evergreen, sent out by D. M. Ferry & Co., seems to occupy the place among early sorts that Stowell holds as a late variety. The ears mature at about the same time as the Concord, but are a little larger, and the kernels are much like Stowell's Evergreen. The quality is superior to that of Concord.

First Crop, from Rawson, resembles Cory, but is not as good, as it smutted badly and the kernels were of poorer quality, but it is a fair, eight-rowed sort.

First of All, one of Buckbee's specialties, is of the Concord type. The ears are good-sized and well covered, kernels broad, deep, tender, sweet; cobs small, but some of them are red and color the kernels in cooking. This is a good medium early variety for home use, as its edible maturity is of long duration.

Table of varieties, Sweet Corn.

Variety.	Seedsman.	Ears per square rod.	No. of days from planting to edible maturity.	Height of Stalks. Feet.	Average.		No. rows of kernels per ear.	Length of kernels. Inches.	Diameter of cob. Inches.	Weight of ears. Oz.
					No. of ears per stalk.	Length of ears. Inches.				
Adams	Wood & Sons	84.89	74	7.5	.6	6.2	10-14	.375	.875	5.6
Asylum	Landreth	91.92	84	7.5	.81	7.8	8-14	.375	1.125	6.7
Best of All	Buckbee	91.92	79	7.	.84	7.7	8	.375	.875	5.4
Beverly	Landreth	91.92	66	4.75	.76	6.65	8	.31	.875	5.05
Champion	Ferry	98.95	86	5.5	.88	6.8	12	.375	1.	6.2
Concord	"	77.86	76	6.	.63	7.2	12-14	.375	1.125	7.2
Country Gentleman	"	113.14	88	7.	1.06	7.4	12-18	.437	.875	5.9
Early Evergreen	"	84.89	76	7.	.83	7.	14-18	.375	1.25	7.6
Evergreen (Stowell's)	"	88.40	99	7.5	.73	7.2	12-14	.375	.875	6.4
First Crop	Rawson	98.95	69	4.	.85	6.5	8	.375	.75	5.6
First of All	Buckbee	113.14	53	6.	.97	8.3	12	.375	.875	7.
Gentry	Wood & Sons	84.89	101	9.	.75	8.6	12	.31	.875	7.2
Giant	Ferry	98.95	84	8.	1.	8.5	8-12	.375	1.125	8.2
Henderson	Henderson	42.41	97	6.	.63	7.6	10-12	.375	.875	6.4
Hickox	Steere	105.97	89	6.	.96	7.2	10-14	.312	1.	7.2
Indiana Wonder	Everitt	77.86	88	8.	.76	7.4	12-14	.312	1.	6.6
Lackey	Gregory	91.92	67	4.	.81	6.6	8	.375	.875	5.3
Maino	Vaughan	98.95	66	3.5	.9	6.4	8	.375	1.	4.8
Mammoth	"	77.86	94	6.5	.66	9.2	14	.375	1.125	8.8
Manhattan	Thorburn	102.46	53	3.16	1.	4.8	8	.312	.75	4.75
Maule XX	Maule	105.97	74	4.75	.86	7.8	8-14	.312	1.	7.8
Melrose	Thorburn	98.95	72	4.33	.66	6.2	10-12	.375	1.	6.
Northrup & King XXXX	Northrup, King & Co.	109.48	82	5.5	.81	6.6	12	.375	1.	7.2
No. 13	U. S Dep't	64.28	53	4.	.95	5.2	8-12	.312	.75	4.
Old Colony	Vaughan	102.46	74	6.	.88	7.2	10-14	.312	1.	6.7
Pennsylvania Rare Ripe	Wood & Sons	105.97	70	6.5	.91	9.4	8	.312	.75	6.7
Silver Coin	Livingston	120.17	84	7.	.92	7.2	14-20	.375	1.125	6.8
Telephone	Salzer	91.92	53	4.5	.77	6.45	8	.312	.875	5.01
Triumph	Rawson	88.41	88	7.	.71	9.	8	.375	.875	7.2
Washington Market	"	105.97	97	7.	.82	7.4	12-16	.437	1.	8.8
White Cory	Vaughan	95.43	57	3.75	.81	5.7	10	.375	1.	5.25

Gentry, sent out by T. W. Wood & Sons, is a large growing variety that resembles Stowell's. The ears are large, uniform and well covered with rich, cream colored kernels. While not superior to Stowell's Evergreen, it is a choice late variety. The stalks are strong and densely covered with long foliage, which makes it desirable as a fodder corn.

Giant, another of Ferry's novelties, is a late variety of good quality and some promise. The ears are very large, symmetrical and covered with broad cream white kernels of the highest quality; cob large and always white, which shows it to be a well selected variety. The stalks are strong growers and seem to stand dry weather.

Henderson, from Peter Henderson & Co., is a medium late sort, which reached edible maturity a little earlier than Stowell. The ears are very symmetrical, uniform in size and well covered; kernels broad, deep set, tender, milky, very white and have a sweet and delicious flavor. This promises to be a very desirable general purpose or market sort.

Indiana Wonder, from Everitt & Son, has slender ears and small kernels that resemble those of Country Gentleman, but are much shorter. The kernels are tender, sweet and milky, but some of the ears are not well covered, due probably to the condition of the weather at the time of setting.

Lackey, obtained from Gregory, proved to be a small growing sort of poor quality. The ears were short and poorly filled; kernels broad with a tough shell, and deficient in richness. It was badly smutted, which is against it as a cropper.

Maine, from J. C. Vaughan, grew much like White Cory, and was of about the same quality. It is a good extra early sort, but not a true sugar corn.

Mammoth, another variety from Vaughan, is one of the choice late standard varieties. The ears are large and are well filled with juicy, sweet, deep set, tender, cream white kernels. This variety should be in every garden, as it is a superior late sort.

Manhattan, from Thorburn, is a dwarf-growing variety which proved of no value, as both ears and stalks were badly smutted.

Maule XX, from Maule, has rather short stalks and closely resembles Concord, but it produces good sized ears, of good quality, a few days earlier than that variety. The kernels are very tender, plump and sweet and cover the entire cob. It promises to be a good general cropper.

Melrose, from Thorburn, is much like Maule XX, but is of inferior quality.

Northrup, King & Co. XXXX, grows a medium sized stalk which produces ears of high quality. They are very symmetrical in shape and are well covered with large, broad kernels. The kernels are deep-set, very tender and rich in sugar.

Old Colony, Vaughan, is a standard sort that needs no description and should always be found in a home or market garden, where a choice, prolific variety is desired.

Pennsylvania Rare Ripe, from Wood & Sons, resembles common flint corn, and as a table sort hardly finds a place among the numerous varieties of higher quality.

Silver Coin, one of Livingston's specialties, has a very strong growing stalk, well set with ears, which are of good size and well formed; kernels milk white, tender, juicy and of rich, delicate flavor. A medium late variety.

Telephone, Salzer, is a small variety much like Cory in size and quality.

Triumph, Rawson, has long, slim ears; kernels are tender and of good size, but they are not very sweet.

Washington Market, also from Rawson, is identical with Egyptian, as grown last year. In quality it is among the best, and it should be more generally grown as a late variety.

No. 13, from U. S. Dept. of Agriculture, is a small variety that was badly affected with smut. The ears are short and the kernels, which were badly mixed, were of medium quality and fairly rich in sugar, but of no established type.

White Cory is one of the best of the early sorts, while Hickox is among the varieties largely grown by market gardeners and for canning or drying. The kernels are of high quality, and shrink but little.

TOMATOES.

The seed was sown in the forcing house March 29. The seedlings were transplanted April 24, and the plants were set out in the field June 6. The rows were six feet apart, and the plants four feet distant in the rows.

In the table below will be found the date on which the first fruit ripened; the number and weight of fruits produced on two plants to September 12, and in the next column the total number of ripe fruit produced on the two plants during the season. The average weight of a single fruit is also given. By dividing the crop into two periods the earliness of the variety is more readily determined.

The "c" following the seedsman's name in the table indicates that the variety has been grown one year at the college and seed saved for the present test:

Among the recent introductions which have not been previously described in our bulletins are the following:

Burbank. The foliage is of ordinary type, but smaller in size and closer in growth. The fruits are borne in clusters as are the cherry sorts, and are round, about one-half inch in diameter and bright red in color. The quality is very high. It is a valuable small fruiting sort for preserving.

Conference. The foliage and fruit are closely like Advance, but it is a week later in ripening. The fruits are slightly larger in size than that variety and the cell-walls are thicker.

Dominion Day. The fruits are of good size, bright red in color and ripen evenly without cracking. The form is somewhat irregular, but not enough so to injure its selling qualities. This variety gave the largest amount of fruit for the early market. A valuable early sort.

Dwarf Golden Champion. Similar in plant and foliage to Dwarf Champion. The fruits are more oblong and not so regular in form as those of Dwarf Champion. A good yellow sort.

Table of varieties.

Variety.	Seedsman.	Date of first ripening.	Fruit ripe Sept. 12.		Fruit ripe Oct. 17.		Average weight of a single fruit. Ounces.
			No.	Weight.	No.	Weight.	
Acme	College	Aug. 18	60	14 lb 14 oz.	106	28 lb. 4 oz.	4.26
Advance	"	" 13	132	20 " 6 "	199	31 " 14 "	2.56
Alexander	"	" 18	77	16 " 12 "	176	38 " 2 "	3.46
Atlantic	"	" 14	64	13 " 5 "	151	36 " 7 "	3.86
Beauty	"	" 23	39	14 " 8 "	72	24 "	5.33
Burbank	Burpee	" 17	-------	-------	-------	-------	-------
Bright and Early	College	" 20	225	30 " 4 "	402	61 lb. 12 oz.	2.45
Conference	Gregory	" 19	136	21 " 6 "	234	39 " 10 "	2.70
Daybreak	College	Sep. 6	3	14 "	110	37 "	5.38
Diadem	Childs (*c*)	Aug. 28	66	23 " 6 "	175	66 " 14 "	6.11
Dominion Day	Bruce	" 14	105	33 " 14 "	171	55 " 2 "	5.15
Dwarf Aristocrat	College	" 15	56	15 "	188	50 "	4.25
Dwarf Champion	"	" 25	88	18 " 7 "	178	36 " 13 "	3.30
Dwarf Golden Champion	Burpee	" 24	86	21 " 8 "	202	50 " 7 "	3.99
Earliest (select)	College	" 9	140	22 " 6 "	278	40 " 2 "	2.31
Earliest (round)	"	" 8	92	16 " 2 "	210	30 " 12 "	2.34
Earliest Market	Buckbee	" 20	110	26 " 10 "	200	47 "	3.76
Egyptian Yellow	College	" 17	142	29 " 12 "	243	51 " 6 "	3.38
Fair, County	Buckbee	" 29	48	11 " 15 "	165	41 " 11 "	4.04
Fair, State	"	" 29	38	9 " 2 "	159	39 " 6 "	4.59
Fair, World's	"	" 23	77	18 " 15 "	156	37 " 1 "	3.80
Favorite	College	Sep. 2	25	11 " 14 "	139	65 " 12 "	7.57
Fifty Day	Fifty Day	Aug. 17	155	10 " 14 "	209	17 " 8 "	1.34
Fiji	College	" 28	48	13 " 4 "	152	45 "	4.73
Freedom	Henderson	" 24	52	14 " 14 "	165	42 " 10 "	4.13
G. A. R.	Gregory	" 24	23	7 " 13 "	122	38 " 13 "	5.09
Golden Glory	Salzer	" 29	35	12 " 4 "	149	52 " 1 "	5.52
Golden Queen	College	Sep. 2	28	14 " 2 "	127	35 " 12 "	4.50
Golden Prize	Buckbee	Aug. 28	25	6 " 6 "	136	39 " 12 "	4.67
Honor Bright	Livingston (*c*)	Sep. 5	22	8	166	44 " 6 "	4.27
Ignotum	College	Aug. 24	45	15 " 14 "	189	70 " 12 "	5.98
Lemon Blush	"	" 25	51	14 " 5 "	138	44 " 5 "	5.13
Lemon Yellow	Livingston (*c*)	Sep. 5	12	5 " 12 "	125	54 " 8 "	6.97
Logan Giant	Everitt	" 4	10	9 " 2 "	63	54 " 2 "	13.74
Lorillard	College	" 2	43	13 " 6 "	184	71 " 10 "	6.23
Novelty	"	" 2	20	7 "	139	27 " 10 "	3.18
No. 105 (Johnson & Stokes)	"	" 3	44	22 "	181	85 " 14 "	7.59
Ponderosa	"	" 8	2	1 " 12 "	51	25 " 2 "	7.87
Potato-leaf Ignotum	"	Aug. 29	32	9 " 14 "	151	66 " 2 "	7.00
Ruby	"	" 18	61	19 " 10 "	171	42 " 2 "	3.94
Seedling (W. Va. Ex. Sta.)	"	Sep. 6	4	3 " 2 "	31	19 " 4 "	9.93
Shah	"	" 2	29	10 " 14 "	99	43 " 6 "	7.01
Terra Cotta	"	Aug. 28	59	17 " 6 "	170	44 " 14 "	4.22
Trophy	Wood	" 28	24	8 " 12 "	157	68 " 12 "	7.28
Yellow Prince	Livingston	Sep. 2	19	6 " 14 "	125	42 " 2 "	5.39

Earliest Market. The fruits are of medium size; some are round, but the greater number are somewhat irregular and ridged. The color is a bright red and the quality is good. A very good medium early variety.

County Fair. The growth of the foliage and plant is similar to Dwarf Champion. The fruits resemble those of Acme in form and color. The quality is high and the plants are productive. An excellent sort.

State Fair. Similar to County Fair in plant growth. The fruits resemble those of Dwarf Aristocrat, but will average larger in size. The upright habit of the plant and the good form and excellent quality of the fruit are the valuable points of this variety.

World's Fair. Appears almost if not quite identical with Dwarf Golden Champion in plant and fruit.

Fifth Day. An early ripening sort, bearing purplish red fruits. The variety is productive, but the size is too small to be of much value as a market tomato.

Freedom. Foliage and plant of the ordinary type. The fruits are round, smooth, and color evenly a bright red. Promising as a medium early market sort.

G. A. R. Foliage of ordinary type, but the leaflets are large. The fruits resemble those of Ignotum closely. Excellent in quality and a valuable sort.

Golden Glory. Fruit much like that of Golden Queen, but it will average larger in size and the form is more regular. It was earlier in ripening and the plants were more productive than those of Golden Queen. A most excellent yellow varity.

Golden Prize. Foliage somewhat similar to Dwarf Champion, but the plants are of more spreading growth. The fruits grow in clusters, are not so large as Golden Queen and have streaks of red about apex.

Logan Giant. Foliage closely of Ponderosa type, but the leaflets are smaller and lighter green. The walls are very thick and solid and the flesh is dark purplish red and of good quality. The unevenness in form is against it as a market tomato.

Yellow Prince. Foliage and plant of Dwarf Champion type, but of larger and stronger growth. The fruits closely resemble those produced by Dwarf Golden Champion but are larger, more solid and the form is more regular. A good yellow variety.

The following sorts have been grown for two or more seasons:

Advance. This variety has given excellent satisfaction for several seasons as a second early sort. The fruits, while not large, are regular in form, of good color and quality and the plants are productive.

Bright and Early. The fruits are somewhat similar to those of Advance, but are a brighter red in color and a week later in ripening. The plants were very productive and ripened a good proportion of the crop early.

Earliest. This variety has been grown for several years as a first ripening sort. It surely has a place to a limited extent, for this purpose. By systematic and careful selection for several seasons we have developed a superior strain of this variety. Atlantic and Ruby bear larger fruits, but are a week or ten days later in ripening.

No. 105. This variety is somewhat late in ripening, but the plants are very productive and the fruits large, of good color, quality and form. Valuable for productiveness and the large size of the fruits.

Potato-leaf Ignotum. The fruits are larger than those of Ignotum and the plants are as productive. Very desirable for market or for home use.

Terra Cotta. A variety having a thin, velvety skin and flesh of a rich red color and excellent quality. An excellent sort for home use.

Summary of Varieties.

Earliest is one of the best early ripening varieties. Atlantic and Ruby follow Earliest and the fruits are of larger size.

Advance is one of the best early kinds bearing small fruits. Acme, Beauty, Dominion Day, Ignotum, Perfection and Potato-leaf Ignotum are excellent for the general crop.

Golden Queen and Golden Glory are among the best yellow sorts.

Agricultural College, Mich.,
February 10, 1899.

BUSH FRUITS FOR 1898.

BY L. R. TAFT AND H. P. GLADDEN.

Bulletin 171.—Horticultural Department.

Since the last report upon small fruits was issued, several varieties of raspberries and blackberries have been added to the collection and have been sufficiently tested to permit of a report upon their behavior. In the following bulletin notes upon these new sorts as well as upon a number of the older varieties are given. Although a large number of varieties have been introduced with high praise during the last five years, comparatively few have shown greater merit than was possessed by the older kinds; and, as will be noted from examination of the summary given under each of the fruits, the more valuable kinds for ordinary purposes are those that have been in cultivation from five to ten years.

BLACKBERRIES.

Variety.	Vigor.	Date first ripe fruits.	Date last fruit.	Productiveness.	Quality.	Number of berries to weigh 1 oz.
Early King	9.8	July 15	July 29	9.	8.5	10
Early Mammoth	8.	" 25	Aug. 12	5.	8.	7
Eldorado	6.5	" 21	" 10	2.	8.	14
Erie	9.5	" 23	" 10	6.	8.	13
Ford No. 1	8.5	" 21	" 10	6.5	8.	9
Jewett	9.2	" 23	" 10	5.	8.5	10
Kittatinny	9.8	" 23	" 17	5.	8.	10
Lincoln	9.5	" 22	" 12	8.	7.	17
Maxwell	8.	" 19	" 9	5.	9.	14
Reyner	9.	" 23	" 11	8.5	9.	14
Sanford	9.	" 25	" 15	9.	9.2	13
Snyder	9.5	" 22	" 16	8.5	8.5	12
Stone's Hardy	9.8	" 22	" 12	5.	8.5	14
Taylor	9.5	" 23	" 15	8.5	9.	11

Early King. The canes are of vigorous, upright growth and productive. The fruits are large and of good quality. It is early in ripening and the bulk of the crop is ready for market before Snyder and Taylor are ripe. Should be a profitable early market variety. It is somewhat tender and would suffer badly in a cold winter unless protected.

Early Mammoth. The fruits are very large, but so few are borne that the variety has little promise of commercial value. Over one-half of the growth was killed back by the winter.

Eldorado. In previous seasons this variety has been as hardy as Snyder. The past season, however, nearly all the growth was killed by the winter and but few fruits were borne.

Lincoln. Quite hardy and productive, but the fruits are very small and drop too easily from the bushes.

Maxwell. This was the first year of fruiting. The canes were not of strong growth and were quite badly injured by the winter. A few small and imperfectly formed fruits that were of good quality were borne. Further trial is required to test the variety.

Reyner. This was the first crop borne. The variety is good in cane growth and seems to be quite hardy. The berries are short, conical, quite irregular in form, of good quality, but too small in size to be of value as a market berry. If the size of the fruit improves as the plants become older, it may become valuable.

Sanford. First berries borne this season. The canes are of strong growth. About one-third of the cane growth killed by the winter. The fruits are of much the appearance of Snyder, though scarcely as large. A good crop of fruit was borne and the variety seems of considerable promise. Further trial necessary.

Snyder and Taylor are old standard sorts that usually produce a good crop of fruit. The canes will stand an ordinary winter without serious injury.

RASPBERRIES.

The tips of the canes of several varieties of raspberries were killed by the winter, but all had a sufficient amount of live cane growth to bear a full crop of fruit. The soil where the plants were grown is one that dries out very easily and is underlain with quicksand which closely approaches the surface; the cane growth and productiveness are, therefore, not what they would be under more favorable conditions. The plants were sprayed with Bordeaux mixture when the young canes were about one foot high and the anthracnose was thus kept in check until the crop was harvested, when the old canes were removed and burned.

Black and Hybrid Raspberries.

ABBREVIATIONS.

Size.	Form.	Color.
s, small.	r, round.	b, black. g, glossy
m, medium.	c, conical.	p, purple. l, light
l, large.	o, ovate.	o, orange. pu, pubescent.

Variety.	Vigor.	Date bloom.	Date first ripe fruits.	Date last fruits.	Productiveness.	Size.	Form.	Color.	Quality.	No. of fruits to weigh 1 oz.
Black Diamond	7.5	June 2	July 8	July 24	5.	m	r c	b	8.8	28
Columbian	8.5	" 9	" 10	Aug. 3	9.	m	r o	p	8.5	16
Conrath	8.	" 1	" 4	July 20	8.5	l	r	b	8.	19
Edmunds	9.5	" 2	" 1	" 20	8.	l	r	g b	8.5	23
Eureka	9.2	" 1	" 1	" 23	9.	l	r c	b	8.	18
Gregg	9.	" 4	" 8	" 25	8.5	l	r	b pu	7.	21
Kansas	9.	" 2	" 1	" 20	8.5	l	r	g b	8.5	23
Lotta	9.5	" 4	" 6	" 24	8.5	l	r c	b	9.5	18
Munger	9.5	" 1	" 7	" 26	9.	l	r c	b	9.	16
Nemaha	9.	" 4	" 5	" 24	8.	l	r	b pu	7.5	20
Onondaga	8.5	" 1	" 4	" 21	7.5	m	r c	b	8.5	26
Palmer	7.5	" 1	June 29	" 18	8.	s	r	b	8.5	35
Poscharsky No. 7	9.5	" 3	July 5	" 24	9.4	l	r c	b	8.5	22
Smith (Giant)	9.	" 1	" 5	" 24	9.	m	r c	b	8.	25
" (Prolific)	9.5	" 3	" 3	" 21	8.5	m	r c	b	9.	26
Stahelin	9.5	" 1	" 2	" 23	8.	s	r c	b	7.	38
Shaffer	8.2	" 4	" 8	" 23	8.	l	r s	p	8.5	15

Black Diamond.—Did not make as good a showing as last season. The canes were of weak growth and the few berries borne were below average size.

Columbian.—Perhaps the best of the purple-cap class.

Conrath.—An excellent medium early variety. Good in cane growth and productive of large-sized berries.

Edmunds.—Plants from Ed. Reynolds, Owosso, Mich. The canes are of strong growth. The berries are medium to large in size, quite irregular in form, and of a jet black color, with flesh of good quality, dry but quite firm; they crumble very easily and can scarcely be picked without falling apart.

Eureka.—This variety is good in cane growth and is quite productive. The berries are large in size, though not very firm or of high quality. It is early in ripening and is worthy of extensive planting by the market grower.

Gregg.—An old variety largely planted as one of the best late sorts. The canes are somewhat tender and the variety should only be planted on a high, well-drained location.

Kansas.—An excellent early to medium early variety. The canes are quite hardy and bear a good crop of large-sized fruits. One of the best market berries.

Lotta.—Plants from Storrs & Harrison Co., Painesville, Ohio. The canes are of very strong growth. The berries are large in size and round conical in form. The color is a brownish black, giving the fruit a mottled appearance that is not very attractive. The quality is high and the berries are firm. The plants were set in the spring of 1897. Further trial is necessary to test productiveness.

Munger.—Received from Albaugh Nursery Co., Tadmor, Ohio, and set in the spring of 1897. The variety is excellent in cane growth and very productive for the age. The berries are large, regular in form and jet black in color with considerable fuzz between the seeds. The quality is high and the berries are very firm, making the variety an excellent shipper. A very promising late ripening sort.

Onondaga.—Plants from C. Mills, Fairmount, N. Y., were set in the spring of 1897. Canes of fair growth. Berries of medium size, roundish conical in form, jet black in color and somewhat fuzzy between the seeds. The fruits are firm, rather dry, but of fair quality. A good variety but not of special merit.

Palmer.—Usually one of the best market sorts. The past season the canes were of weak growth, unproductive and the berries of small size.

Poscharsky No. 7.—Received from Poscharsky & Son, Princeton, Ill. The plants are strong and very productive of good sized fruits. The berries resemble Gregg in appearance but are better in quality. A very promising medium late sort. Plants set in the spring of 1897.

Smith (Giant).—Plants from A. M. Smith, St. Catherines, Ont., were set in the spring of 1897, and have made an excellent growth. The berries are of medium size, regular in form, jet black in color, of fair quality and quite firm. A good variety, but it has nothing to specially recommend it.

Smith (Prolific).—Canes of very vigorous growth. The fruits are only medium in size but of good quality. Productiveness medium.

Stahelin.—Received from F. J. Stahelin, Bridgman, Mich. Plants set in the spring of 1897. The canes were of good strong growth but the fruits were very small in size. Of no value as grown this season. Further trial is necessary.

Shaffer.—One of the best varieties for canning and home use. The canes are quite subject to the attack of anthracnose, and the variety is objectionable on that account. Fruits inclined to crush.

Red Raspberries.

ABBREVIATIONS.

Size.
s, small.
m, medium.
l, large.

Form.
r, round.
c, conical.
o, ovate.

Color.
d, dark. o, orange.
r, red. b, bright.
p, purple.

Variety.	Vigor.	Date bloom.	Date first ripe fruits.	Date last ripe fruits.	Productivenes.	Size.	Form.	Color.	Quality.	No. of fruits to weigh 1 oz.
Church	8.	June 3	July 2	July 23	7.	l	r c	d c	8.5	18
Cuthbert	9.	" 11	" 3	" 28	8.5	l	r c	r	8.5	15
Kenyon	8.5	" 6	" 4	" 25	8.	l	r c	r	9.5	17
King	7.5	" 6	" 4	" 23	6.	l	r c	r	8.5	21
Loudon	8.5	" 6	" 3	" 26	8.	l	r c	d c	9.5	16
Marlboro	8.5	" 8	June 24	" 19	8.5	m	r	r	7.5	19
Phœnix	8.	" 5	" 29	" 23	8.8	l	r c	d r	9.5	18
Stayman No. 1	8.5	" 11	July 16	Aug. 4	6.	l	r c	d c	9.	14

Church.—The fruits are very attractive in appearance and of good quality, but have the serious fault of falling to pieces when picked.

Cuthbert.—This is probably the best red raspberry, all points considered, for market purposes.

Kenyon and Loudon, as grown here, appear to be identical. The fruits are large, very attractive in appearance, of high quality and firm. They may possibly prove to be better sorts than the old, reliable Cuthbert to plant for market.

Marlboro.—Largely planted as an early variety.

Phoenix.—The canes are not of very strong growth but are fairly productive. The fruits are of good size, rich dark red in color and of high quality. Early in ripening and a promising variety.

Stayman No. 1.—Berries very large, rich dark red in color and of good quality. The canes are of upright growth and as they make but few laterals to bear fruit, the variety is low in productiveness.

Summary.

The following varieties of raspberries, of those grown here, are the most promising for central Michigan:

Black Caps.

Palmer, closely followed in season by Eureka for early, Conrath and Kansas for medium season and Gregg for late. Of the newer sorts Edmunds is promising for early or second early and Munger, Lotta and Poscharsky No. 7 for late.

Purple Caps.

Columbian and Shaffer are probably the best of this class.

Red Varieties.

Cuthbert is still the leading sort of this class planted for late, though Loudon is coming rapidly to the front. Marlboro is most generally planted for early. Phoenix is a very promising second early variety for market or home use.

GRAPES.

The season of 1898 was very favorable for the grape, and nearly all varieties set well with fruit.

August Giant.—Bunch of medium size, irregular in shape, loose; berries large, round, black, covered with reddish bloom; skin thick and tough, juicy. The quality is rather poor, and the flavor foxy. Ripens the first of October.

Belvidere.—Bunch medium to large, open, shouldered; berries of medium size, round, blue-black; skin thick, tough and fleshy. The quality is good and growth of plant strong and healthy. It is very productive and would probably be a good market variety. It is not a good keeper, as the grapes drop quickly from the stems. Ripens the last of September.

Berckmans.—The vine is productive though not of strong growth. The clusters are not large but of good form. The grape is purplish-red in color and of fair quality. A good amateur variety, but of little value commercially. Ripens the last of September.

Brighton.—This is probably the best red grape for home use or for market. The canes are of strong growth, quite healthy and productive and the grape is of high quality. Ripens the middle of September.

Champion.—A black grape of some value as an early market variety. The quality is poor. Ripens the last of August.

Chidester No. 3.—A young vine and but few clusters borne. Bunch of good size, oblong, usually shouldered, quite close and compact. Berries vary much in size, round, red with purple bloom. The quality is very good. Ripens the middle of September.

Delaware.—An old sort of superior quality that should have a place in every home vineyard. The variety is quite subject to mildew and is not a strong grower. Ripens the last of September.

Diamond.—The plants are hardy and productive; the clusters are of good size and compact in form. Berries large, yellowish-green in color and good in quality. An excellent variety for home use, or for market. Season a week earlier than Concord.

Diana.—Plants are productive. Bunch compact. Berries of medium size and pale grayish-red color. The quality is very high. The variety is an excellent keeper but ripens in October, usually too late for most sections.

Eldorado.—Vines seem to be hardy and are productive. Clusters of medium size, tapering, usually shouldered and quite compact. Berries are of medium size, round, yellowish-green in color, juicy; pulp tender, sweet. Excellent in quality and a good keeper. Ripens the first of September.

Empire State.—In some sections a valuable white market grape. It is better in quality than Niagara, but not so large in bunch and berry. Ripens the last of September.

Hayes.—An early white grape of superior quality. The canes are not of very strong growth and scarcely productive enough to make the variety of commercial value. Ripens from the first to the middle of September.

Jessica.—A white grape ripening the last of August or the first of September. It is of fair quality and the canes are of good growth and productive. Of some value as an amateur variety.

Moore Early.—The variety most largely grown as an early market grape. It is fairly productive, the clusters are of medium size, and the berries are large, black, but not of very high quality. Season two weeks earlier than Concord.

Niagara.—Perhaps the leading white market grape. The vines are vigorous in growth, healthy and productive. The clusters and berries are large and the quality good. It is a little later in season than Concord.

Pocklington.—An excellent yellowish white grape. A little earlier in season than Niagara. It is scarcely as productive as Niagara and the cluster and berry are smaller in size. The flavor is pleasant but somewhat foxy.

Prentiss.—The cane growth is slender and rather weak. Clusters small, oblong, rounded at base, compact. Berries small to medium, varying greatly in size, slightly ovate in shape, greenish yellow color, with lighter bloom, skin thick and quite fleshy. The quality is good and it seems to be a good keeper. Hardly likely to prove of commercial value. Season the middle of September.

Progress.—Strong and healthy in growth and productive. Clusters of medium size, broad at base, tapering and usually shouldered, compact. Berries of medium size, black, covered with deep blue bloom. The productiveness and form of bunch and berry make it a good market grape. The quality is low and the flavor foxy. Season the first of September.

Superb.—A young vine and but few clusters were grown; these were of medium size, broad at base, tapering, usually quite open. Berries medium in size, round, black. The quality is high. Ripens the first of September.

Vergennes.—Vigorous and healthy in growth. Clusters large and compact. Berry large, dark purple color, with green markings. The quality is good and the variety is valuable for its late keeping qualities. Season the last of September.

Witt.—Vine young but producing some very good clusters. Bunch of medium size, usually shouldered, broad at base and tapering. Berries of fair size, round, yellowish white color, sweet and of high quality. Appears to be an excellent variety for home use. Season the first of September.

Winchell.—The variety is strong and healthy in growth and productive of good sized clusters compact in form. Berries of medium size, round, color light green, skin thin but firm, pulp sweet and of very good quality. Perhaps the best early white grape for home use or for market. Ripens the first of September.

Worden.—Probably the best black grape for home use or for market. It is a week or ten days earlier than Concord, fully as productive and better in quality.

Agricultural College, Mich., February 10, 1899.

COMBATING DISEASE-PRODUCING GERMS.

BY CHARLES E. MARSHALL.

Bulletin 172.—Bacteriology and Farm Hygiene Department.

Modern methods on the farm demand that the old-time house cleaning should not stop short of barns and buildings in which domestic animals are sheltered. This custom, however, antiquated it may seem, of scouring, cleaning, painting and whitewashing, has doubtless been the means of saving thousands of human lives by excluding various dreaded forms of disease. People are now in a position to recognize the advantages accruing from such a custom and can appreciate the importance of its extension to the dwellings of domestic animals, because its object is known and its success apparent. By an occasional cleaning out of all the accumulated dirt and filth, by a thorough washing, whitewashing and disinfecting, they believe that not only is the tone and appearance of these buildings improved, but that the possibility of epidemics of contagious diseases is greatly lessened and the vigor of the animals increased many fold. It is not practicable to point out the exact value in dollars and cents of these methods, yet every candid person realizes the true measure of their worth. An estimate can be made only by comparing what is done in eradicating and shutting out contagious diseases of human beings with what may be done in eradicating and shutting out contagious diseases of animals. In the history of contagious diseases affecting the human family, contagion has always been more or less intimately and materially associated with dirt and filth.

When London suffered so severly from the plague in the sixteenth century, everything was ready for its reception and propagation. The city was badly situated; an old town ditch acted as a receptacle for all kinds of filth; the streets became the dumping ground for slops and of excrement from animals and human beings. Poor ventilation and filth were dominant in all houses of the poorer sections of the city. The sanitary condition of this part of the city, to which the plague was almost entirely confined, was of the worst possible type, such as only squalor, poverty, filth and ignorance of the laws of health can originate. London lost thousands and thousands of people from this scourge. At that early day, London was not able to keep it out; now it can be stopped even though it appear right at her door.

When this same plague became epidemic in Hong-Kong in 1894, it was largely confined to the poorest and most ignorant classes. Its victims numbered about ten thousand, but when it appeared at Canton previously, it did not leave before one hundred thousand had perished. Now it is sojourning in India, and its progress is hard to stay on account of the unsanitary surroundings. Its cure is mostly prevention by personal clealiness, sanitary dwellings, city drainage and an absence of overcrowding. Typhoid fever is another disease which finds its home in filth. The prevalence of this disease in army camps indicates an accumulation of filth and unsanitary surroundings occasioned by improper drainage, defective disposal of garbage and the contamination of water and food supplies incident upon the necessarily hasty and incomplete sanitary arrangement of camps. Smallpox has been practically eliminated and shut out of Michigan, owing to the untiring efforts of our State Board of Health and efficient local boards. Diptheria does not spread over large tracts of country as it once did. Scarlet fever is now controlled with little difficulty. Unless it be consumption, contagious diseases of the human family are not looked upon with the dread that once accompanied the name. The bridle that has been placed upon them is due largely to the strenuous efforts made to improve sanitation, to a knowledge of their causes and to the practical lessons learned from a study of their causes and applied to the advancement of sanitation and prophylactic measures. Although bridled, many years will be required before they will be absolutely controlled; yet, even at the present time, we feel practically safe with safeguards in stringent laws.

What has been done in reducing contagious diseases in the human family can be to a large extent repeated in the reduction of contagious diseases among animals. In the case of tuberculosis or consumption among the domestic animals, it is possible to so control the disease that it will not spread. This is accomplished by methods similar to those used in staying a contagious disease belonging to man. The individual is isolated and kept under quarantine until all danger is passed. A domestic animal so treated would confine the disease to itself and not disseminate it broadcast. Acknowledgment must be made, however, to our regret and shame, that no effectual means is used either with man or animal to check the progress of the dreaded white plague. The only plausible excuse that can be offered is that it is not so rapid in running its course nor so apparently drastic in its mortality as a contagious disease that rages a short time and is over.

In the case of hog cholera, however, the owner of hogs has a disease which may be in some respects likened to Asiatic cholera in man. Because of the fearful ravages of Asiatic cholera in man and a knowledge of the causal agent, Asiatic cholera has practically been controlled. In hog cholera or allied troubles, the causal agent is known and the ravages are enormous, but the disease is not checked. This must be due to one of three reasons: First, an ignorance of prophylactic measures which should be adopted under such circumstances; second, an unwillingness to carry into effect prophylactic measures when known; third, an inability to prevent the spreading of the disease whenever prophylactic measures have been made use of. Of these three reasons there is evidence which indicates that the first and second are usually at the foundation of the trouble, for if a man is ignorant of the regulations necessary to stop the progress of a contagious disease, he cannot be expected to make any effort whatever in confining it. There are, it is true, circumstances which are not under the control of the stock owner even when he exercises the utmost precautions in attempting to keep a contagious disease from his herd. Cats, dogs, flies, birds, all can carry the contagion, and these the owner of stock cannot manage.

Should anthrax enter a community in Michigan, it would probably cause more or less consternation. Its ravages would incite great alarm because of the rapidity of its course and the quickness with which it spreads from animal to animal. It does not limit itself to any single class of domestic animals, but may attack most of them. When it has once gained a foot-hold it is almost impossible to eradicate it. Its persistency lies in the endurance of the spore stage of the germ. Localities are known where it has existed for hundreds of years. At one time it would take the severe epidemic form and then subside for a period, only to rise again in its fury at a later period. Under such conditions, cattle raising becomes precarious. This disease, however, can be controlled and is controlled, but only when aggressive methods are adopted. In England, a very contagious disease, pleuro-pneumonia, has been practically rooted out. This has been done entirely by the killing and burning of every animal suspected of having the disease. In this country, glanders is not as prevalent as it was once, simply because drastic measures were adopted in stamping it out. In South Africa, where severe contagious diseases are very common, it is not unusual for the government to place certain sections of the country under an armed patrol whose business it is to confine the contagious disease to the infected districts and to prevent its passing beyond.

In the management of contagious diseases of man, it is customary to isolate the individual and to shut off all communication between him and the outside world. All food that goes to the individual is taken to the door and there left for the nurse to take into the room. When the patient is through with the dishes, the nurse places them in a pail containing boiling water, which has been left at the door for the purpose. This treatment kills any of the germs adhering to the dishes. The water in the pail may be cold when the dishes are put in and then heated to the boiling point if desired. By this means all communication is shut off and the germs are not allowed to spread beyond the immediate vicinity of the patient. The nurse stays with his patient and is not allowed in any manner to communicate with the outside world. When the patient convalesces, his person undergoes a disinfection. The nurse disinfects himself, and the room, with all of its contents, is thoroughly disinfected. By stringently following such methods, contagious diseases have been known to affect only one of the family, while the rest of the family escaped.

The same methods should be followed when contagious diseases affect any of the animals belonging to the farm. As soon as it is known that the disease is contagious, every sound animal should be removed to a place where the disease has not existed. In removing them, it would be a wise precaution to wash the animals with some disinfecting solution. They should be carefully watched and as soon as one is noticed to be sick, it should be immediately removed and placed with the sick animals. The sick animals should be confined in as narrow a space as possible, so that the contagion will not be spread over a wide area. After the separation of the well from the sick has taken place, the greatest care should be exercised that none of the virus be carried on the boots, clothes or person of the man or men in charge. If possible, every means of communication, however great or however trifling, should be completely cut off. If it is suspected that food or water has been the means of introducing this disease, there should be no hesitancy in stopping its use. In carrying out a system of isolation, it must be thorough if it is successful. No half-hearted spirit should undertake it.

After the disease has run its course, it is entirely dependent upon the nature of the disease to determine what method shall be followed. This determination should in every case be left to a competent veterinarian, who alone should attend to the management of examinations that may be required in the case. Where the disease is not all-persistent, after a few weeks have elapsed, there need not be any great necessity for disinfecting the places where the sick animals have been. But this is a dangerous plan to follow, for we are not always aware of the persistency of any germ. The wisest and safest way is to thoroughly disinfect the places occupied by the sick animals.

Should any of the animals die, the only reliable method in disposing of them is to burn their carcasses. The ordinary methods of dragging them from one end of the farm to the other and burying them are exceedingly dangerous and pernicious and lead only to further trouble. If proper attention is given, perhaps the burying of carcasses may be accomplished without any danger, but it should not be done unless burning is impossible. To do it safely, a hole at least six feet deep should be dug and some quick-lime placed in the bottom. The dead animal should be placed upon this quick-lime and covered over with another thick layer of quick-lime. The remainder of the hole may then be filled in with earth.

More or less disinfection will have to be resorted to in most cases. This introduces a new chapter which cannot be treated in a meager way, because of certain principles involved which must be thoroughly understood. To do justice to such a theme as this will require detailed discussion and directions.

DISINFECTION.

Disinfection is directed against the agents which cause contagious diseases, and it undertakes to fight as though in single combat with an individual germ, for it is recognized that there is always present some living micro-organism which serves as the propagator of contagious disease. This living micro-organism is the real virus which is so much dreaded.

In connection with disinfection there are terms which are closely allied and which should be differentiated and explained. Agents which are used to antagonize bacteria are known as germicides, disinfectants and antiseptics. By a germicide is understood an agent or substance is one form or another which is capable of extinguishing completely the life of a germ. The term disinfectant is more specific in its use and is generally confined to the destruction or devitalization of some particular obnoxious germ. An antiseptic is an agent which possesses the power of preventing the growth of germs which produce a diseased condition.

In attempting to draw distinctions between the above terms we are cognizant of the fact that their scope has not been exhausted and their boundaries have not been well defined. The desire is to give a general impression of their force and meaning as well as to place them in their proper relations.

It may be advantageous and may also explain some incongruities which will follow hereafter to briefly state some of the difficulties encountered in determining the true value of germicides, disinfectants and antiseptics, and why it is there is so much apparent discord in the works of different investigators when dealing with these agents.

If a micro-organism as an invisible microscopical plant is viewed in the light of ordinary plants with which we are acquainted in our every day observations it will be possible perhaps to arrive at a more satisfactory conclusion than by thinking of germs in the abstract and as invisible objects. Should the growth of a vigorous plant be watched and the obstacles with which it has to contend be noted during its progress, its strong powers of resistance would be very prominent. On the other hand, should the plant be weak and lacking in the power to push ahead, the obstacles which had little influence over the strong plant would become fatal enemies to the weak. In bacterial life there are the strong and the weak germs. While a germicide may act with great rapidity in the case of the weak, it may not be able to cope with the strong. Especially is this true when the two forms of the same germ are considered. The vegetative form and the spore form are as distinct in their relations to germicides as it is possible for two different species to be. The vegetative form is the germ before the spore has germinated within it, and yields quite readily to the action of germicides. After the spore has formed, germicides act with great difficulty because of the strong resistance offered by the spore wall. In anthrax these two forms of a germ are found. The vegetative form succumbs easily, while the spore form has been known to exist for years subject to agents fatal to the vegetative form. This explains why it is undesirable to open an animal dying of anthrax, for in the body of the animal before it is exposed to the oxygen of the air, the germs are in the vegetative form and are more easily killed; but upon coming in contact with the air, the vegetative forms are converted into the spore forms, which are exceedingly resistant.

There are other difficulties to be met, not from the standpoint of the germ but from the standpoint of the investigator who tries patiently to establish he true value of germicides, disinfectants and antiseptics. These difficulties are largely technical and are known only to the laboratory man who has devoted some attention to this work.

Simply a mention of the above difficulties will suffice to present what obstacles stand in the way of an exact determination of agents whose characters have been described above. In reviewing the agents used as germicides, disinfectants and antiseptics, only those which are of practical utility to the farmer will be mentioned. Those which are very good but too expensive for general application will be omitted in this consideration.

HEAT.

This agent will be found one of the most useful of germicides or disinfectants, for whenever it is possible to apply the flame direct, as a cleansing agent, or in the destruction of contaminated material; whenever a dry heat may be used to advantage in destroying a virus upon instruments, dishes or metallic substances, and whenever steam heat or boiling water may be employed for rags, clothes or any fabrics which will not be injured by such usage—dishes, knives, forks, in fact, anything that will stand steaming or boiling—this agent, heat, becomes applicable in one form or another.

The direct flame is very useful in consuming contaminated material about the farm, in burning the carcasses of animals dying of contagious diseases, in destroying rags and old clothes which have come in contact in any way with contagion, and in short, consuming anything that has a tendency to scatter the disease, such as the discharges from the nostrils, the mouth and the bowels. Whenever material containing the germ of a contagious disease is burned, all danger has disappeared. All thoughts about dogs digging up carcasses and the possibility of an incomplete disinfection of any material that may be handled afterward are removed and the assurance that the utmost has been done to eradicate the disease gives great relief to the conscience.

Hot air is usful in a great many instances when instruments or metallic substances, glass ware and crockery are to be disinfected and when it is undesirable to apply steam heat or hot water, and the direct flame is out of the question. It cannot be recommended very highly for the disinfection of clothes, rags or anything of a textile nature.

Steam heat and boiling water are perhaps the most common and useful disinfectants that we have, for they can be used for pails, cloths, dishes, which have been employed by patients suffering from infectious diseases, bedding, clothes, curtains, carpets, instruments, anything that will not be affected by the action of steam or hot water.

Heat is the most efficient disinfectant we have and should always be borne in mind when any disinfection is to take place, because of its cheapness and its extensive application. It also acts more quickly and is more certain of destroying virus than any other agent that can be named.

Besides heat, cold may be incidentally mentioned as a disinfectant. Cold has no power of destroying or devitalizing bacteria. It may stay the growth and development of bacteria but it falls far short of possessing germicidal or disinfectant properties.

CHEMICAL SUBSTANCES.

In chemicals are found agents which may be utilized when heat in any of its forms is not available. The more prominent chemical germicides, disinfectants and antiseptics will be briefly reviewed in order to give the reader a comprehensive knowledge of the substances commonly employed.

Mercuric Chloride.—This substance is also called corrosive sublimate and bichloride of mercury. It is a salt of mercury that has become a very useful and a very common agent with which to fight bacteria. This may be mostly due to its inexpensiveness and the satisfaction which it has given. It may be procured from any druggist at one dollar per pound or thereabouts. After the solution has been made and properly diluted there will be a large quantity for disinfectant purposes.

The great value of mercuric chloride is not recognized by all experimenters, mainly on account of its peculiar action. If, however, its chemical affinities are kept in mind, its action upon bacteria may be easily gained. It has been demonstrated that this salt in solution acts upon the immediate surface of the germs, or perhaps the germ-wall, by forming a coat which appears to prevent further growth or development of the cell. If this coat be removed, there usually remains sufficient life in the cell to continue its development under proper conditions. How long this coat may retard the activity of a cell is still an open question, but it is generally assumed that the cell is eventually killed by the slow penetrating poisonous power of the mercury or is held captive indefinitely by the failure of a solvent to act upon the mercuric cost.

Yersin has discovered that a solution of one part of mercuric chloride to one thousand parts of water will kill the tubercle bacillus in one minute. On the other hand, Schill and Fischer with a solution of one part of mercuric chloride to two thousand parts of water were unable to destroy the virulence of tuberculous sputum when equal amounts of the sputum and solution were used. This may be accounted for by the affinity of mercury for the proteid material in the sputum and the consumption of the mercury present by the formation of some insoluble salt which would not allow the mercury to act upon the tubercle bacilli. According to Fraenkel, the spores of anthrax are destroyed in thirty minutes by a solution of one to one thousand, but this probably means that the spores are restrained rather than actually destroyed, because the later work with mercuric chloride tends to show that the actual destruction of germs or spores does not take place immediately or in a very short period.

Notwithstanding the fact that mercuric chloride may not act as a rapidly destroying agent but as a rapidly restraining agent, there is no hesitancy in recommending it as a valuable germicide or disinfectant, especially in the absence of albuminous matter.

The strong affinity which mercuric chloride has for proteid material may be greatly decreased by the use of sodium, potassium or ammonium chloride. With this purpose in view, a concentrated solution of mercuric chloride, together with one of these salts, is prepared as a stock solution and is always ready for use upon dilution. This overcomes a great difficulty in the use of mercuric chloride, which is so slow to dissolve in water. The following will give the parts used for a concentrated solution:

1 part of mercuric chloride.
2 parts of sodium chloride (common salt).
5 parts hydrochloric acid.

Five parts of this solution, by measurement, to nine hundred ninety-five parts of water will give a disinfecting solution of one to one thousand. If a solution sufficiently diluted for application is desired, the following formula will answer:

1 part mercuric chloride.
2 parts sodium chloride (common salt).
1,000 parts of water.

A solution of one to one thousand is perhaps the most commonly used for disinfecting purposes or as a germicide, but if it is to be used as an antiseptic or as a wash for wounds, great care should be exercised to avoid using strong solutions on large, raw, and mucous surfaces, where there is danger of absorption resulting in general mercuric poisoning. Mercuric chloride is a very strong poison, and should always be treated as such.

Carbolic Acid (Phenol).—Carbolic acid in its pure form is crystalline. The crystals may be easily liquified by the application of heat. If allowed to cool again it will recrystalize, unless water to the amount of five per cent of the carbolic acid is added to prevent recrystalization. In this ninety-five per cent form, pure carbolic acid is usually purchased at drug stores and is doubtless more convenient for use. If more water than is necessary to prevent recrystalization be added, there will be a separation of water and acid until the acid becomes diluted to the amount of five per cent of the diluent water. This will account for the difficulty with which a six per cent or larger per cent solution of carbolic acid is made.

Carbolic acid has long been used as a disinfectant and germicide and is still regarded as possessing great value. The ease with which it may be handled and the effctiveness of its action may account for its popularity and its wide use.

Koch has demonstrated that anthrax spores were not affected by a one per cent solution for fifteen days, but that a two per cent solution prevented development. Crookshank has reached the conclusion, after careful work, that carbolic acid is by far a more valuable germicide or disinfectant than mercuric chloride, and he would use it more generally than the latter substance. According to Sternberg, pus cocci are destroyed by a solution of one to one hundred and twenty-five in two hours. The germs of Asiatic cholera, typhoid fever and pus cocci are killed by a one per cent solution, but a one-half per cent solution fails in most cases. The investigation of Schill and Fischer indicate that a three per cent solution will disinfect tuberculous sputum in twenty-four hours. If there is no danger of poisoning and a drastic disinfectant is desired, a five per cent solution is recommended, but if application is to be made on the surface of the body or parts of the body, nothing stronger than two or three per cent should be used. Upon mucous and raw surfaces, one-half per cent is as strong as is safe to use as an antiseptic.

Formalin—(Formal, formaldehyde.)—This agent is of recent development. Tests made with it, however, have proved its great worth as a germicide, disinfectant and antiseptic. It promises to supplant some of the more prominent agents now in use. It is a gas soluble in water to the extent of forty per cent, and upon the market it will be found in aqueous solution. In this form it may be used as a liquid agent, or it may be regenerated by a suitable apparatus into the gaseous form and used where sulphur fumes are now employed.

All tests made of this substance in gaseous form give it the foremost place among practical gas disinfecting agents. This place has been maintained by it through all the applications made, and it now holds in practical disinfection an undisputed position.

Roux and Trillat made use of a great variety of materials upon which many well-known pathogenic germs were placed and subjected them to the action of formalin. These germs were placed in widely separated parts of a large room. Their results indicate a most favorable germicidal action. They state that the destruction of pathogenic bacteria submitted to the tests was absolute in a space of fourteen hundred cubic meters when the germs were freely exposed to the vapors of formaldehyde; that the sterilization of the dust of the air and of walls submitted to the test can be considered as practically absolute. Pfuhl has also contributed a series of experiments which elaborate further upon the usefulness of this gas disinfectant. Hammer and Feitter, in their work upon the specific action of formalin on the anthrax bacillus, have proved that a two to five per cent solution of formalin is effective. Novy and Waite have compared it with sulphur and have demonstrated that formalin has many advantages over sulphur. They say: "One apparatus is sufficient, regardless of the size of the room or rooms to be disinfected. The same apparatus can be used for almost any number of disinfections in the course of a day. The distillation of formalin into an ordinary room need not take more than twenty-five or thirty minutes. It is easily portable, since it is very light and is not voluminous. Inasmuch as it remains on the outside of the room before the eyes of the operator, there is absolutely no danger of fire or explosion. The apparatus, formalin and fuel are inexpensive." These same investigators state that one hundred and fifty cubic centimenters will suffice to disinfect one thousand cubic feet of space, when liberated as a gas.

Sulphur.—This material has a very favorable history to bear testimony to its effectiveness. There is no means of knowing how much it has wrought for mankind. Its value may be partly attested by the constant and widespread employment made of it. Furthermore, experiments confirm what experience has credited to it, and although formalin has arisen as a very strong competitor, yet sulphur has not been wholly displaced.

Sulphur fumes are obtained by the burning of sulphur rolls or brimstone which may be bought at any drug store at a very low price. The dry fumes do not possess much virtue as a germicide, but in connection with sufficient moisture, they become very active. In the absence of spores, the anthrax bacilli were killed in thirty minutes, but in the presence of spores there was no direct appreciable action. Very favorable reports are recorded, however, with such pathogenic germs as glanders, typhoid fever, cholera, diphtheria, tuberculosis and others; these results have been borne out by experience in practical disinfection.

Whitewash (Calcium Hydroxide).—Whitewash that is so frequently used about houses, barns and stables is recognized through experience to be a great aid as a purifier. It cannot be said to be a strong germicidal agent nor can it be relied upon to accomplish the purpose in hand when it is used alone. Sternberg has killed the germs of typhoid fever in a solution containing one to forty of calcium oxide—that is, lime before the water is added. One part of lime to eighty parts of water failed. Spores of anthrax and other spore-forming species were not killed by two hours exposure to the milk of lime containing twenty per cent of calcium oxide. Jäger has applied whitewash to walls, using silk threads soaked in cultures of various pathogenic germs for testing. The sporeless variety of anthrax, the germ of glanders and several other pathogenic germs were killed after twenty-four hours by a single application, but the tubercle bacillus was not killed by three successive applications.

Mr. Rigterink, who carried on a series of experiments in this laboratory to determine whether whitewash possesses any disinfecting or germicidal properties, has arrived at some very interesting results which are well worthy of mention. His conculsion is as follows: "Whitewash prevented the growth of bacillus anthracis, bacillus of hog cholera, staphylococcus pyogenes aureus, bacillus typhi abdominalis, where the whitewash was brought in direct contact with the germs. Whitewash did not prevent the growth of the spore form of bacillus anthracis."

"Whitewash should always be applied while it is fresh and hot to be effective."

Chloride of Lime.—(Bleaching Powder, Calcium Hypochlorite.)—This material is usually found upon the market in sealed packages, and is labeled "chloride of lime." Its value is in the available chlorine it contains. It is an excellent disinfectant, and also acts as a deodorizer. Typhoid fever germs are killed quickly, and even the resistant spores of anthrax are destroyed by its influence.

In applying to to floors or to the ground, it is more economical to suspend it in water, for it is not soluble, and then sweep it around with a broom. In the disinfection of stools, the dry substance may be placed upon them to the amount of about one-half to one per cent. It may also be used in disinfecting the hands by forming a paste over the surface of them.

Salicylic Acid.—This acid is widely known for its preservative qualities and for its important role in many anti-ferments sold on the market. It is a white crystaline substance in its pure state and is easily obtained at any drug store. As a germicide it does not take a very high place when compared with the others that have been discussed. Besides, it is more expensive than the others mentioned. Its promiscuous use as a preservative and in the form of an anti-ferment cannot be too severely condemned when the article preserved is intended for food consumption. It may be a difficult matter to define the limits of a poison upon the human system, yet there is sufficient evidence to indicate the possible injuries that may result from its use. A French commission reported that its prolonged use, even in very samll amounts, is dangerous, especially to aged people.

Boracic Acid.—This acid is a weak germicide and a preservative. Its poisonous properties are not so distinctly marked as those of salicylic acid, and yet it cannot be regarded, in the quantities used as a preservative, as a very suitable substance to take into the system. Sternberg says that pus cocci are not killed by it in a saturated solution when exposed for two hours. However, when strong antiseptics or preservatives cannot be used, boracic acid may be employed to advantage and without danger.

HOW TO DISINFECT.

When an attempt is made to eradicate the germs of a disease by means of disinfection, there are several points to be considered, viz.: The object to be disinfected, the disinfectant to be used, the cost of the disinfectant and the time consumed in carrying out the operation. What has been stated in the foregoing pages regarding disinfectants treats of them in the abstract, their comparative worth, and inferentially the cost. It now remains to apply these agents to the disinfection of the things farmers are most likely to have. Only the methods are given which will yield the best results at the least possible expense of time and money.

No method is effiective unless it is carried out in a thorough manner. Some surgeons operate without having any pus form in the wound; other surgeons operate and always have more or less pus formation in the wounds, even in these days of aseptic and antiseptic surgery. In the former case, the surgeon is careful and follows bacteriological laws exactly; in the latter case, the surgeon is exceedingly careless or is ignorant of these laws. Ignorance in such a case is no excuse, because every surgical operation is founded upon these laws. This is equally true of disinfecting operations. If there is a willingness to abide by the established rules of practice, good results will be obtained, but if there is an indifference and a disregard for such methods, no reliance can be placed upon the results. First, understand the method, then follow it with painstaking care.

DISINFECTION OF INSTRUMENTS.

Knives, saws, axes, shovels are included as a representative of the instruments which may be used about animals having died of some contagious disease, or perhaps may be wanted for use in some surgical or post-mortem work in connection with animals.

Boiling or steaming for two or three minutes is the most suitable and most effective way of sterilizing instruments. This temperature will kill the most formidable pathogenic germs and will render said instruments free from danger. This method is sometimes impracticable, and in its place a chemical solution may be substituted. For this purpose, a five per cent solution of carbolic acid will render the instruments innocuous. They should remain in the solution at least thirty minutes, and the solution should permeate every particle of material that may be upon the instruments and should cover their entire surface. It would be well to remove all adherent material upon the instruments before putting them into the solution and burn this material in a flame. A solution of corrosive sublimate should never be substituted for carbolic acid because of its corrosive action on metallic substances.

DISINFECTION OF DISHES.

Dishes used by persons sick with infectious or contagious diseases should always be disinfected and diligently cared for. A repetition in part of what has already been said may be pertinent.

It frequently happens that a single member of a family is confined to a certain part of the house with some contagious disease. At such times, the food is usually prepared in the kitchen and carried to the door of the sick chamber, where it is left for the nurse to convey to the patient. Dishes handled by the patient and nurse and exposed to the contagion of the disease in the room cannot escape becoming infected, and should not, under any circumstances, be carried back to the kitchen to pass through the ordinary cleaning process without additional attention. At the door of the sick chamber should be a pail of hot water to receive these dishes, and the water should be brought to the boiling point before the dishes are removed. By this means it is possible to confine the disease germs to the room of the patient, provided the nurse does not go beyond the room. This also applies to dishes used by tuberculous patients who are at large; that is, the dishes used by them should undergo disinfection in boiling water.

Pails and buckets belonging to the house or barn, if brought in contact with any infectious or contagious disease, should also be thoroughly disinfected. The same pail or bucket should never be used to feed both the sick and the well, whether man or animal. If animals are confined on account of some contagious disease they should have their individual pails. This is essential if success be attained by the method of isolation.

DISINFECTION OF CLOTHES AND RAGS.

When clothes and rags are used for cleaning articles contaminated with disease germs, or when employed about patients with contagious or infectious diseases or purulent sores or wounds, there is only one safe way by which disinfection may take place, and that is by burning. It is true that such articles may be boiled and washed, but when we know them to be saturated with virus and know the possibility of the dissemination of that virus if the proper precautions are not taken, there is only one conclusion in the matter. If there is little danger associated, boiling may be resorted to and disinfection accomplished successfully. Unless the individual is thoroughly familiar with the requirements of the case, nothing short of burning should be adopted or entertained.

DISINFECTION OF CLOTHES, BEDDING, CURTAINS AND CARPETS.

No single method can be recommended in the disinfection of the articles named above, because, while one method may be applicable to one article, it may not be applicable to another; consequently to decide upon what method to follow, it is necessary to consider whether disinfection may be employed without the destruction of the article or whether the destruction of the article will be necessary to render it safe. Again, steam may be employed safely in one case, hot water in another or some gas in still another, and the value of the article retained. It should be remembered that the fumes of sulphur act as a decolorizing agent and are likely to destroy the color in some fabrics. Formalin has little or no action upon color, has comparatively great penetrating power and has been found to be exceedingly useful as a disinfectant in a gaseous form. Steam under pressure is very effective, but this, of course, is beyond the reach of farmers. Steam under atmospheric pressure and boiling water are within the reach of everybody, are comparatively inexpensive and very valuable as disinfectants.

To make the methods systematic and easily understood, it may be desirable to state them as follows:

First. Burn all that has little value. It is customary to keep on hand old clothes, curtains, bedding and carpets, which should always be utilized in case sickness of a contagious nature appears, and which can be disposed of more easily and more safely by fire than by any other means.

Second. Boil all that may be disinfected without injury. If necessary, rip the bedding or other articles which are difficult of penetration, and which may be concealing obnoxious germs. Personal wardrobes, curtains, bedding and carpets frequently may be boiled without injury. Incidentally it may be stated to advantage that expensive curtains, carpets, clothing and bedding should never be allowed in the sick chamber where there is an infectious or contagious disease. Use only such articles as are absolutely necessary and are of little expense, so that they may be disposed of without pecuniary loss at the end of the illness.

Third. If neither burning nor boiling is available, the use of formalin gas can be recommended. Hang the articles on a line in a room, spray them with water and fill the room, after it has been thoroughly closed, with formalin gas. This may be done when the room is undergoing disinfection.

Fourth. The employment of dry heat is not reliable. Furthermore, it cannot be made a very practicable method for farmers.

THE DISINFECTION OF ROOMS.

To disinfect a room requires neither an expensive apparatus nor costly disinfectants, yet it cannot be satisfactorily accomplished unless the utmost care be given to every detail. Every cranny and nook, every crack and hole must receive its share of attention. The room should be laid bare of all its furnishings and every obstacle which stands in the way of thoroughness should be removed. Every article that is to be disinfected, together with the room, should not in any way be allowed to interfere or vitiate the work. In this instance, only the room free from all of its contents, will be considered.

The first step is to remove every particle of dust in the room with a cloth dampened in a solution of corrosive sublimate, one part of corrosive sublimate to five hundred parts of water, or a three to five per cent solution of carbolic acid. In doing this it will be necessary to wipe off the woodwork, wall and ceiling. The floor should be mopped with one of the above solutions. If corrosive sublimate is used, it would perhaps be better to make the solution one part to one thousand, to avoid leaving too much of this substance to dry on the floor, thus causing, possibly, an irritation of the nose and throat, should it get into the air. Immediately after this has been done and while the woodwork, walls and ceilings are still damp, either burn sulphur or liberate formalin in the room as follows: About four pounds of sulphur should be used to every thousand cubic feet of space. To have it efficient, sufficient moisture must be present. This may be provided by placing an iron dish containing sulphur in a tub with a few inches of water in it. By so doing, not only is the moisture provided, but also a safe means of burning sulphur. To light the sulphur, pour over it a little alcohol, just enough to start it well.

Formalin may be conducted through a keyhole from the regenerator, or the regenerator may be placed in the room. The former method may be regarded as the safer. The gas is regenerated from the forty per cent solution under pressure by the use of an apparatus especially designed for the purpose, or it may be, according to Novy, regenerated from a very simple device by means of rapid ebullition. (See Teachers' Sanitary Bulletin, Vol. I, No. 3 of the State Board of Health.) These two methods are used to prevent any change in the formalin, which is very likely to occur when the regeneration is slow. Of the two, Novy's must be regarded as the simpler, for there is only a small tin can with a small tube leading from it to the keyhole. In the other, which requires pressure, an automatic valve is needed additionally.

One hundred fifty cubic centimeters or five ounces of formalin to every thousand cubic feet of space is placed in the can and the tube of the apparatus is connected with the keyhole of the door. The lamp or stove is started underneath the receptacle and the regeneration takes place in a very short time. After all the formalin has been liberated, the apparatus is removed and the keyhole plugged.

Whether in the case of sulphur fumes or formalin gas, the room should be completely closed. There should remain no cracks or holes in the windows or doors, or any part of the room, by which gas may escape.

If sulphur is used, the room should remain closed for forty-eight hours; if formalin gas is employed, from six to eight hours will be effective.

Should there be any furniture in the room, it may be treated as the woodwork in the room and subjected to the gas.

DISINFECTION OF CREAMERIES, CHEESE FACTORIES AND DAIRIES.

What is applicable to the disinfection of a room is in general applicable to the disinfection of the above with slight modifications.

The dairy or factory is always supposed to be absolutely clean, but unfortunately this is too often a fake supposition, for it is not infrequently the case to find filth and dirt extending to the very edge of the vat, covering the outside of the tanks and spreading over the floor and all the woodwork. So thick is it many times that it may be scraped off in thick layers. To use gas or disinfecting fluids under such condition is like washing sin out of the human body by applying water to the surface. To disinfect a dairy or a factory of this kind effectually means that every particle of dirt and filth must be removed and the woodwork practically polished. The dirt and dust must be removed from every crack, the vats and tanks must be scoured, the seams and corners cleaned out. After this is done, wash the woodwork which does not come in contact with the milk or milk products in any way with a three to five per cent solution of carbolic acid. Use boiling water or steam to disinfect the inside of vats, tanks and utensils. Do not use chemical disinfectants for any surface which comes in contact with milk or milk products. After this has been done, all holes and cracks should be stopped to prevent the escape of formalin gas or sulphur gas, which should be used in the same manner as in the disinfection of rooms. It is understood that no milk or milk products should remain in the room during the process of disinfection, and the room should be well aired before using it again.

Paint and whitewash will add much to the disinfection by way of cleanliness and tidiness. They will also make cleaning less difficult and will tend to keep the creamery or factory free from unwholesome odors.

DISINFECTION OF BARNS AND STABLES.

Unless the barn or stable is sealed over, the unevenness of the timbers, the large cracks and rough lumber usually used in building a barn or stable render disinfection difficult. The more smoothly finished and the less the number of cracks and corners to clean out and disinfect, the less will be the expense for material and for labor, and the more thorough will be the execution. Whatever the expense, disinfection becomes necessary at times or the building must be used for other purposes than for sheltering animals; for if a single animal is saved by the effort, the reward is sufficient to meet the expense incurred in the operation. However, when a barn is properly constructed, the cost of disinfection may be reduced to the minimum and it becomes a small matter.

At the beginning of the operation, all dirt and dung adherent to the walls, mangers, floor, and wherever it may be found, should be thoroughly removed. To do this effectively, it may be necessary to add sufficient water to soak the hardened material until it may be easily removed by a hoe or scraper. The success of the undertaking is largely dependent upon this first step.

Following a thorough cleaning is the spraying with a solution of corrosive sublimate, the strength of which is one of corrosive sublimate to one thousand parts of water. Spraying is particularly mentioned as the most rapid process of using the solution. Inasmuch as mercury attacks everything metallic, it is necessary to either use a wooden spray-pump or a more complex device suggested by Prof. Taft, the horticulturalist of this station. By this latter method a metallic spray-pump may be used by placing it in a barrel half full of water. In another barrel is placed a solution of corrosive sublimate of a strength of one to five hundred. This barrel is closely corked and is connected with the force pump by means of a tube. Leading out from the barrel is also another tube, which is used for spraying. The water is now forced into the closed barrel under pressure so that the solution is forced out for spraying purposes. This of course makes a solution of from one to five hundred to begin with, and after half a barrel of water has been pumped in, it is diluted to one to one thousand. When this point is reached, sufficient mercuric chloride is added to make the solution up to one to five hundred again. The barrel which contains the pump is again filled half full with water and the operation is repeated as before. By this method, a metallic pump may be used without coming in contact with the solution. Although the solution is one to five hundred at times, it will do no harm and will be, if anything, more effective.

The spraying should be continued until all the ceiling, walls, woodwork and floor have been thoroughly wet down.

Having applied the corrosive sublimate solution two coats of whitewash should follow. To be most effective and satisfactory, the whitewash should be put on with a brush while it is hot and in the process of slacking. In this condition the whitewash has better disinfecting properties and adheres more securely to the walls and ceiling. Perhaps, however, the matter of expense in whitewashing after this method may exceed the advantages gained, and a faster but not so desirable method may be more practicable. The lime may be slacked a day previous to the whitewashing, strained through burlap and then put on with a spraying pump. This can be done very rapidly.

There are so few barns in which a gas disinfectant may be used, because of the many chances of its escape, that it cannot be usually recommended. If a barn is sufficiently tight to hold the gas, it may be used under the same rules as were designated in the disinfection of rooms.

DISINFECTION OF PASTURES AND YARDS.

The disinfection of large tracts of land must be regarded as impracticable with artificial disinfectants. When an infectious disease is prevalent, it is wise, as far as possible, to confine it to a small area. However, there are many instances where this has been found utterly impossible, and the contagion has been spread over large fields. In this case, it is necessary to leave the disinfection to the direct rays of the sun and the weather and employ the field for cultivation instead of pasture for a period of time. If it were possible to expose all the obnoxious germs to the direct rays of the sun, the difficulty would be easily unraveled, but it is merely the uppermost layer of the soil, and a very thin layer at most, that is exposed, so that to rely upon the direct rays of the sun entirely is unsatisfactory. With most pathogenic germs the conditions provided by the soil are not suitable for their sustenance; they consequently become weakened and less dangerous. There are resident in the soil the germs of symptomatic anthrax or quarter evil, and tetanus or lockjaw, which are able to induce these diseases if the proper circumstances exist. A class of bacteria, while not naturally belonging to the soil, finds itself associated with the soil by means of filth. The germs of chicken cholera, hog cholera and typhoid fever are not infrequently found in such environments, and they are able to exist thus for an indefinite period of time.

If an artificial disinfectant must be resorted to, a layer of slack lime or chloride of lime is recommended for t is work. Chloride of lime is always preferable to slack lime.

DISINFECTION OF STOOLS AND URINE.

The excreta of both animals and man suffering from infectious diseases become at times one of the gravest sources in spreading disease. Many of the contagious diseases are confined largely to the alimentary tract and are disseminated because no attention is given to the disinfection of discharges. Some contagious diseases also give off the contagion through the urinary tract. It is because contagious diseases are so frequently disseminated by means of excreta that the necessity for proper disinfection is urged. The diseases of anthrax, tuberculosis and typhoid fever are known to be scattered through the excreta. The germs of hog cholera, chicken cholera and similar diseases find their exit from the animal through frequent discharges. On account of this common means of dissemination, the widespread infection of the above diseases may find a partial answer.

Perhaps the best means of dealing with excreta is to confine animals in a small compass and thus prevent them from running at large. This will permit the use of chloride of lime, slack lime and carbolic acid in sufficient quantities to be effective. If animals are allowed to run in large fields, the fecal matter should be collected and disinfected. This will not only lessen the danger of spreading the disease, but will permit the sun to act, where the droppings have been removed.

DISINFECTION OF SPUTA.

This may seemingly apply to a greater degree to human sputa than to the discharges from the mouth and nostrils of animals. There is no doubt connected with the dissemination of diseases, through the expectoration from patients, and if we are to judge from the limited examinations of bovine tuberculous sputa, we have no hesitancy in saying that this source of contagion is by no means barren. It is a recognized fact that the rubbing of noses practiced by cattle is no less a deleterious practice than that of promiscuous kissing practiced in human society. There is only one conclusion following from this; that is, complete isolation of animals suffering from contagious diseases and so far as possible keeping the discharges of mouth and nostrils under control by the use of disinfectants. Human subjects are either provided with a paraffined envelope or a well-stoppered bottle, which receives the sputum, and in the house with a cuspidor containing some disinfectant, as bi-chloride or carbolic acid. This brings the sputum absolutely under the control of the individual, and prevents the scattering of contagion.

DISINFECTION OF THE HANDS.

Farmers often are obliged to disinfect their hands after post-mortem work, and should do so when assisting in operations on animals or whenever there is a possibility of carrying infectious material by means of the hands. It is not my purpose to give elaborate methods more suitable for surgeons than for the practical farmer, but we wish to give simple methods of cleansing, which can easily be carried out. First of all, the finger nails should be cleansed and brushed with soap and water, removing every particle of dirt so far as possible and the hands thoroughly cleaned. When this has been done, wash the hands thoroughly in a solution of mercuric chloride, the strength of one to one thousand, or of carbolic acid, the strength of three per cent. Allow these solutions to dry spontaneously and never use a towel. If it is desired to keep the hands practically sterile, do not allow them to touch anything until ready for work.

DISINFECTION OF THE PERSON OR ANIMAL.

To disinfect an individual who has been associated with contagion or who is convalescing from some contagious disease, simply means giving him a bath in a two per cent solution of carbolic acid or a solution of corrosive sublimate, the strength of which should be one to one thousand. These solutions should be brought in contact with every part of the body, but not in contact with any mucuous surface. For mucuous surfaces use a ten per cent solution of boracic acid.

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KILLING THE TUBERCLE BACILLUS IN MILK.

BY CHARLES E. MARSHALL.

Bulletin 173.—Bacteriological Department.

Led to this work by expressions of doubt concerning the value of pasteurization when the bacillus tuberculosis is in question, I have attempted to present in a brief way a limited review of a few experiments made by others and some carried on at this laboratory, in order that the readers of Experiment Station bulletins may form a reliable judgment and may guard against danger. Pasteurization for other purposes than killing the tubercle bacillus will not form a part of this treatise. For a general consideration of pasteurization and its objects, bulletins Nos 133 and 147 may be consulted.

Whether milk ever contains the tubercle bacillus or not will not be discussed; the conclusions of eminent experimenters will be assumed as beyond contradiction that the tubercle bacillus is found in milk from tuberculous cows in no small per cent of cases. Such milk has been demonstrated to be infectious upon lower animals; and in the case of man, which direct demonstration is precluded, indirect evidence has been adduced which has established the relation of known tuberculously infectious milk to certain cases of human tuberculosis almost beyond a doubt. In a future bulletin, tuberculous milk and its infectious nature will be treated in detail.

Woodhead has made extensive experiments with the tubercle bacillus to ascertain a safe method to render it innocuous in milk. One statement which he makes has much significance when possible tuberculous infection is in dispute. He says "milk from tuberculous udders is in all cases possessed of the power of setting up tuberculous infection." This opinion will designate the true position of Woodhead from whom valuable work and suggestions will be quoted. "It was found," he says, "that the exposure of even virulent tuberculous milk to a temperature of 85° C. (185° F.) for five minutes is sufficient to render it innocuous, although the same material brought rapidly to a temperature of 90° C. (194° F.) still retains some power of infection.

The following detailed result of Woodhead may be given to advantage, both in interest and in their practical bearing:

"Positive result momentarily heating 90°C. (194° F.)
" " 22 min. " at 75°C. (167 °F.)
" " 30 min. " at 70°C. (158° F).
" " 3 hrs. " at 65°C. (149° F.)
" " 12 hrs. " at 60°C. (140° F.)

Heating longer than this rendered the germs innocuous by inoculation."

[By "positive results,"—inoculation tests were made upon lower animals with some of the milk after treatment to determine whether the milk was still infected or not. If an animal succumbed to tuberculosis, he, Woodhead regarded the result as positive.—Author.]

In another experiment the tuberculosis material was heated to different temperatures for various periods of time, and then fed to pigs. This is illustrated as below:

“Temperature	2½ min.,	5 min.,	10 min.,	15 min.,	20 min.,	30 min.,	40 min.,	45 min.,	1 hr.
60°C. (140° F.)						+			+
65°C. (149° F.)					+		+		
79°C. (158° F.)	+			+				+	
75°C. (167° F.)		+	+	+					
80°C. (176° F.)		+	+						

+ = Positive.
— = Negative.
= No experiments were made.”

Even in the feeding experiments, there is much which points to the durability of tuberculous virus. This table is worthy of the gravest consideration, for it indicates the possible harm arising from tuberculous milk which has neither been thoroughly nor properly pasteurized. Before giving any further attention to the above results, it is desirable to quote still more of his experiments in scalding milk. “Experiments were made as to the effect of the ordinary process of ‘scalding’ milk in which the milk in the earthenware jar or tin pan is placed in another pan containing a quantity of water, which is then brought to the boiling point. It was found that, under these circumstances, the temperature of the milk of the upper part raised much more rapidly than that of the lower part. In one experiment, after the milk had been on the fire for fourteen minutes, the temperature at the top was 71.1° C. (160° F.), while at the bottom is was 56° C. (133° F.); at the end of twenty-six minutes, the temperature at the top was 92° C. (198° F.), at the bottom, 83.5° C. (182° F.). In another experiment, with a stronger flame, these differences were less marked. These experiments clearly proved that the mere scalding of milk by bringing the outside water up to the boiling point, was quite inadequate to sterilize tuberculous milk.”

The following directions are given by Woodhead for the pasteurization of milk when it is desired to arrest souring or when it may be necessary to make use of milk from an unknown or suspicious source: (1.) “The quantity of milk should never be more than the quantity of cold water by which it is surrounded; it is, in fact, an advantage to have a larger bulk of water than of milk to allow for evaporation. (2.) The milk should not be covered in and should be stirred from time to time, but the water may with advantage be covered, in order to prevent evaporation; this of course is arranged for, in special milk sterilizing pans. (3) The water should be boiled over a good brisk flame, in order that the best results may be obtained, and the heating process should be continued until the temperature throughout the milk has risen to from 88° C. (190° F.) to 92° C. (198° F.); in most cases this takes place at the end of about twenty-five minutes, but in order to be perfectly safe it may be recommended that every quart of milk treated in this fashion, should be heated for half an hour—that is, for about twenty minutes after the water in the outer pan has begun to boil.’

The most striking feature of Woodhead’s elaborate experiments is, perhaps, the high thermal death point required for the killing of the tubercle bacillus. The ordinary methods employed in pasteurizing milk would be regarded by him as unsafe. From others, however, different views are obtained.

Freeman says: “As far as the ordinary bacteria are concerned, pasteurization at 140° F. gives almost as good results as that of 167° F. The milk is freed from almost all the living germs, and those pathogenic bacteria which are most likely to cause disease are also destroyed. The only pathogenic bacterium which is not destroyed by a short exposure to a temperature of 140° F. or less is the bacillus tuberculosis, but there is evidence that this micro-organism is destroyed by a temperature of less than 140° F. of sufficient duration.” The evidence of the most recent observers, he says, seems to him sufficient to conclude that a temperature of 140° F. kept up for fifteen minutes is sufficient to kill bacillus tuberculosis, and he recommends pasteurization at or between 149° F. or 167° F.

A pasteurizing apparatus has been tested by MacFadyean and Hewlett, which consists of a coil of pipe heated to 68°-72° C. (153°-160° F.) and requiring thirty seconds for the milk to pass through. This would be the same practically as heating the milk at 68°-72° (153°-160° F.) for thirty seconds. To test whether the tubercle bacillus was killed by this means, they took tuberculous sputum dried over sulphuric acid, powdered it and mixed it in sterilized milk. Two guinea pigs inoculated with 2 c. c. each before pasteurizing died exactly a month after. The glands, spleen, mesentery, liver, lungs and peritoneum were riddled with tubercle. Three guinea pigs inoculated each with 2 c. c., after pasteurization, showed no trace of tubercle upon careful post-mortem.

The investigations of Forster, Deman and Bonhoff demonstrated that the tubercle bacillus is killed by the action of heat applied at

50° C. (131° F.) for 4 hrs
60° C. (140° F.) for 1 hr.
65° C. (149° F.) for 15 min.
79° C. (158° F.) for 10 min.
80° C. (196° F.) for 5 min.
90° C. (194° F.) for 2 min.
95° C. (203° F.) for 1 min.

Yersen by the use of the culture method has stated that the tubercle bacillus exposed to the heat of

55° C. (131° F.) for 10 minutes grew in 10 days.
60° C. (140° F.) " " " 22 "
70° C. (158° F.) " " and above failed to grow at all

In an article by Griffith on the pasteurization of milk, the assumption is made that the tubercle bacillus is killed at 68° C. (156° F.) to 70° C. (158° F.), and follows the views of Bitter and Freeman, each of whom recommended 68° C. (156° F.) to 69° C. (159° F.) for pasteurizing purposes. Griffith, however, calls special attention to the care necessary to proper pasteurization. Here he has certainly detected one grave source of error. Pasteurization under no circumstances can be accomplished in a haphazard manner.

Sternberg has given his work on the killing of the tubercle bacillus by heat. He has found that the bacillus heated for

10 minutes at 90° C. is killed.
10 " " 80° C. "
10 " " 60° C. "
10 " " 50° C. is not killed.

The wide differences noticeable in the review of the above experimenters may apparently be difficult to adjust, yet a possible reconciliation may be forthcoming by a study of the different methods employed and the various strengths of the virus used.

A comparative experimental study of the same virus under all the different methods in practice would be necessary for a satisfactory solution of the former question. This is not a part of our work. Woodhead similated the methods customarily used, but they were unreliable in his hands. On the statement of other investigators, the methods in vogue are regarded as effective and satisfactory. If the manner of determination has led to opposite views of the effectiveness of pasteurization, some method will have to be devised by which uniform results may be obtained and ordinary methods of pasteurization unquestionably settled. The thermal death point in Woodhead's studies was determined under as natural conditions as it would seem possible. yet there may be errors arising from these very conditions. Others have used the germ under artificial cultivation. This may introduce grave errors, because the tubercle bacillus does not thrive the same under artificial cultivation as under natural. What influence the manner of determining the thermal death point of the tubercle bacillus has upon the important methods of pasteurization in vogue, cannot be stated in definite terms. It must be settled by further work.

The tubercle bacillus is generally conceded to possess different degrees of durability, concerning which definite knowledge is available. There is strong evidence that certain forms of the bacillus react differently than other forms. In sporogenic bacteria, there are always two forms to be considered, the sporeless forms and the forms with spores, the thermal death points of which are widely separated. Again, it is believed that spores, we will say, under different stages of development, possess greater or less durability. Accordingly, when it is desired to determine the thermal death-point of any species of bacteria, instead of establishing fast lines which may be followed in full faith, there must constantly be some indefiniteness. This is truer of spore forming bacteria than the sporeless kind. Now the tubercle bacillus is usually regarded as a spore forming bacillus, and his spore nature is so meagerly known that it is practically impossible to differentiate the two forms of this germ; consequently it is not strange that variations in the results of determining the thermal death point should occur. This seems the more plausible way of explaining an apparently contradictory situation, such as has been presented in the review given.

This bulletin does not pretend to solve the question that has been raised by the review and discussion so far, but rather to contribute its share in the work required of many workers before our knowledge shall be adequate to safely reach conclusions.

In the past, all pasteurizing done at this station has conformed to one standard. The milk, after it has reached 68° C. (155° F.), has been held for twenty minutes at this temperature, and then cooled as quickly as possible. Bringing the milk up to 68° C. (155° F.) requires some time, the length of which is dependent upon the amount of milk and water, also upon the strength of the flame. No direct experiments have been made until now to ascertain whether this method of pasteurization would render milk safe from the action of the tubercle bacillus, should it be present.

In each experiment 10 c. c. of milk was used. It was sterilized and then allowed to cool. Tuberculous material was then added and thoroughly macerated in it until evidences of tuberculous material could be detected in its consistency. Before subjecting this mixture to pasteurization, guinea pigs were inoculated with it to test its virulence. It was then pasteurized as described above, that is, as soon as the temperature reached 68° C. (155° F.), it was held at that point for twenty minutes and then cooled as quickly as possible. After the pasteurization, guinea pigs were inoculated with this pasteurized mixture, to determine whether the tubercle bacillus was dead.

For each experiment, tuberculous material was obtained from a different source. The object of this was to test the durability of tubercle bacilli coming from different sources and presumably existing under somewhat different conditions, and perhaps in different forms. In every case the material came from tuberculous cows which were killed in an advanced stage of tuberculosis or had died of that disease. Such, we believe, is the material which would naturally find its way into milk. No effort was taken to secure tubercles in the incipient stages of growth or in the most advanced, but rather to take parts of several in all stages of development.

The tuberculously infected milk was placed in a shallow dish for pasteurization. The thickness of the layer of the milk in the dish could not have been over one quarter of an inch. This allowed ready transmission of heat, so that one part of the milk would not be one temperature and another part higher or lower. The dish was placed in the bottom of a pail sterilizer and this placed on a water bath. This pail sterilizer is described by Novy in Cent. f. Bakt. Bd. xxii. S. 340. Heat was applied under the water until the temperature registered 68° C. (155° F.) in all parts of the vapor chamber. By means of a Reichert's thermo-regulator, this temperature was maintained constantly for twenty minutes.

The inoculations of guinea pigs before and after pasteurization with the results will be detailed below:—

Experiment 1. Guinea pig, No. 44, was inoculated intra-abdominally with 1 c. c. of the tuberculously infected milk before it was pasteurized.

This animal died of general tuberculosis ten weeks later. Lungs, liver, spleen, lymphatic glands and peritoneum were seriously affected with the disease.

Guinea pigs, Nos. 41, 42 and 43, were each injected intra-abdominally with 5 c. c. of the same milk as used in the case of No. 44 after it had been pasteurized.

At no time did any of these animals show symptoms of the disease either by appearance or by weight. They were all chloroformed when No. 44 died, but traces of tuberculosis could not be found upon careful examination.

Experiment 2. Guinea pig, No. 75, was injected intra-abdominally with 1 c. c. of tuberculously infected milk, before it had been pasteurized. The tuberculous material in this experiment was obtained from another animal.

Four weeks later the pig became so emaciated and sick that is was chloroformed. Upon post mortem, the lungs, liver, spleen and lymphatic glands were highly affected with the disease.

Guinea pigs, Nos. 76, 77 and 78 were each injected intra-abdominally with 5 c. c. of the same milk used for No. 75 after it had been pasteurized. They were all chloroformed at the same time that No. 75 was examined, but careful examination revealed no lesions of tuberculosis.

Experiment 3. Guinea pig, No. 127, was inoculated intra-abdominally with 1 c. c. of tuberculously infected milk before undergoing pasteurization. The tuberculous material used in this experiment came from a different source than in the two previous experiments.

This animal died of general tuberculosis twenty-four days after inoculation. The lungs, liver, spleen and lymphatic glands were thoroughly tuberculous.

Guinea pigs, Nos. 128, 129 and 130 were each inoculated intra-abdominally with 5 c. c. of the same milk used in the case of 127, after it had been pasteurized. At the time No. 127 died, these animals were chloroformed and carefully examined for tuberculosis, but not a tubercle could be discovered. There were no indications of tuberculosis whatever.

Experiment 4. Guinea pig, No. 142, was injected intra-abdominally with 1 c. c. of tuberculously infected milk from a source still different from experiments one, two and three, and before it had been pasteurized.

Four weeks later this animal died of general tuberculosis. Lungs and abdominal organs, except the kidneys, as well as lymphatic glands, were in an advanced stage of tuberculosis.

Guinea pigs Nos. 138 and 139 were each inoculated with 5 c. c. of the same milk used in the case of animal No. 142, after it had been pasteurized.

These animals were chloroformed upon the death of pig 142, but no trace of tuberculosis could be detected upon close examination.

Experiment 5. Guinea pig, No. 143, was inoculated intra-abdominally with 1 c. c. of tuberculously infected milk before it had been pasteurized. The tuberculous material was taken from a source still different from one, two, three and four.

This animal died of general tuberculosis three weeks later; lungs, liver, spleen and lymphatic glands were almost a mass of tubercles.

When No. 143 died, Nos. 140 and 141 were chloroformed. No tuberculous lesions could be detected in either of them after much searching.

In these five experiments, Nos. 44, 75, 127, 142 and 143 were each inoculated with 1 c. c. of tuberculously infected milk before it had been pasteurized; in each case the tuberculous material used to infect the milk was taken from a different source, Every guinea pig inoculated with this material macerated in milk died a few weeks later, although the time from inoculation to death varied considerably.

The above five animals acted as controls for Nos. 41, 42, 43, 76, 77, 78, 128, 129, 130, 138, 139, 140 and 141, which were inoculated with the respective samples of milk, the same as were used with the five above, but after they had been pasteurized. The amount used in these inoculations was five times the amount used for the five controls.

Every one of the controls died in the advanced stages of tuberculosis, while not one of those receiving the pasteurized milk, even in quantities five times as great, showed any trace of tuberculosis. Thirteen animals remained untouched by tuberculously infected milk subjected to a heat of 68° C. (155° F.) for twenty minutes.

These experiments do not accord with Woodhead's, yet they give about the same results as have been recorded by others. Whether it is possible to kill the tubercle bacillus below 68° C. (155° F.), exposed for twenty minutes, is beyond our present endeavor, since milk may be pasteurized at 68° C. without alteration or the production of a cooked flavor. It is not best or essential that a lower point should be adopted. As soon as a lower degree is considered, the greater and more complicated will be the questions involved. From our own experience, we have found that 60° C. (140° F.) for ten minutes will not kill the tubercle bacillus. This degree and time have been used to kill other pathogenic germs in the presence of the tubercle bacillus that the tubercle bacillus might be allowed to act upon animals. This is a recognized method of operation when two pathogenic germs interfere with each other. From 60° C. (140° F.) to 68° C. (155° F.) is a narrow range, and if it were possible to raise the temperature a few degrees more without interfering with the composition and quality of the milk, it would be advisable. If the taste of American people could become accustomed to cooked milk, the matter of pasteurization against pathogenic bacteria would be easily accomplished.

Errors may creep into the process of pasteurization without notice. For this reason some stress has been placed upon the uniformity of heating as is commonly practiced. A receptable containing the milk is placed in a pot of water and the water raised to 68° C. (155° F.). The milk is allowed to stand in the water for twenty minutes, then cooled. The milk is usually covered and is not stirred during the process. We have similated this crude method as closely as necesary to demonstrate its worth.

A dish 2¾ inches in diameter and holding 340 c. c. (a little over 11 oz.) was placed in a water bath eight inches in diameter. The volume of water in the water bath was made equal to that of the milk in the receptacle. The heat was applied and during the process of heating the temperatures of the water and milk were taken.

The temperatures recorded are those at the bottom of the dish of water and about the center of the bulk of milk.

Time of Recording Temperature.	*Temperature of Water.*	*Temperature of Milk.*
10:00 o'clock	13½° C.	15° C.
10:02 "	21° C.	15° C.
10:03 "	29° C.	15°
10:07 "	36° C.	18° C.
10:10 "	43° C.	24° C.
10:12 "	51° C.	29° C.
10:14 "	56° C.	35° C.
10:16 "	61° C.	40° C.
10:18 "	67° C.	46° C.
10:20 "	70° C.	50° C.
10:23 "	69° C.	58° C.
10:25 "	70° C.	61°.C
10:28 "	70° C.	62° C.
10:30 "	71° C.	65° C.
10:35 "	69° C.	67° C.
10:40 "	68½° C.	67½° C.
10:45 "	70° C.	68° C.

It took twenty minutes to raise the water to 70° C. and forty-five minutes to raise the milk to 68° C. Had the flame been removed when the water was 70° C., the milk would have been 50° C., and had the milk been allowed to stand in the water with the flame removed, the milk might have gone up ten degrees more, but it is very doubtful, while the water was falling ten degrees.

If the milk were to have been properly pasteurized under the above conditions, it would have taken sixty-five minutes.

There was a difference of four or five degrees in the water; the surface was always hotter than any other part. In the milk there was a variation of three and four degrees in different parts.

In another experiment, the same receptacle for milk and the same water bath were used. The amount of milk in this case was 370 c. c., or about 12 oz., and the heat applied was more intense. The water in the water bath equaled the height of the milk in the receptacle.

Time of Recording Temperature	*Temperature of Water.*	*Temperature of Milk.*
11:06 o'clock	17° C.	16° C.
11:08 "	22° C.	18° C.
11:10 "	27° C.	22° C.
11:12 "	32° C.	26° C.
11:14 "	36½° C.	31° C.
11:16 "	41° C	35° C.
11:18 "	45° C.	40° C.
11:20½ "	50° C.	45° C.
11:23 "	55° C.	50° C.
11:25 "	60° C.	55½° C.
11:28 "	65° C.	60¾° C.
11:30 "	68° C.	64° C
11:35 "	69° C.	68° C.

Twenty-four minutes were required to raise the water to 68° C. and twenty-nine to raise the milk to the same degree. There was a variation of temperature between the bottom and surface water of four and five degrees and in the milk of two and three degrees.

In this experiment, the temperature of the milk and water were nearer identical than in the last, and less time was consumed in bringing the milk up to 68° C.

Still another effort was made to establish the relation of the temperature of the water and milk. The vessels were the same as in the last experiment and the amount of milk and water identical. The flame could not be exactly controlled, but it is evident that it was higher than in the previous case.

The water was raised to 68° C. in seventeen minutes and the milk to 68° C. in fifty-four minutes. When the water had reached 68° C., the milk was 50° C. Thirty-seven minutes were required to raise the temperature of the milk to that of the water, after the water had reached 68° C.

Time of Recording Temperature.	*Temperature of Water.*	*Temperature of Milk.*
9:55 o'clock	14° C.	14° C.
9:58 "	26° C.	15½° C.
10:00 "	33½° C.	18½° C.
10:02 "	40° C.	23° C.
10:04 "	45° C.	28° C.
10;06 "	52½° C.	34½° C.
10:08 "	57½° C.	40° C.
10:10 "	66° C.	46° C.
10:12 "	70° C.	50° C.
10:14 "	71° C.	56° C.
10:17 "	70° C.	61° C.
10:19 "	69½° C.	63° C.
10:22 "	69° C.	64° C.
10:25 "	70° C.	65° C.
10:30 "	69½° C.	66° C.
10:35 "	68½° C.	67° C.
10:49 "	70° C.	68° C.

The variations in temperature of water and milk corresponded exactly with the two previous cases. The following lessons may be drawn from the above experiments:

1. Any method which is controlled entirely by the temperature of the water is unreliable.

2. Any method which allows the water and milk to stand for twenty minutes when the water has reached 68° C., without further application of heat, is variable and uncertain.

3. The temperature of the water is no indication of the temperature of the milk, and the only way safety can be guaranteed by the temperature of the water is to heat the water to a sufficiently high degree to render the temperature of the milk safe beyond doubt.

4. There is much variation in the temperature of unstirred water or milk. Milk should be stirred when pasteurized at 68° C. (155°F.)

Many do not dislike the cooked flavor and odor which is produced when milk is heated above 70° C. (158° F.), and they always heat the milk to a higher point than that discussed in this bulletin. The lactalbumin is easily coagulated and the casein may be rendered less responsive to rennet, thus making the action of the pepsin and pancreatin less effective. With many children, this chemical change of the milk would pass unnoticed, but with others it would work apparent injury. If due care is taken in the preparation and modification of the milk, it maybe that the latter class would be somewhat reduced. Should harm result from the heating of the milk to a high temperature, the pasteurization ought to be carried out at 68°. C. (155° F.).

In case the heating of milk to a high temperature does not injure or prove objectionable, a much easier method of pasteurization may be resorted to. To establish some standard to follow which will yield good results, a few experiments have been undertaken. Experiment 1: A vessel is placed on the stove with a pie tin in the bottom. Upon this are placed bottles of small diameter filled with milk and plugged with cotton wool. The water in the vessel should equal the height of the milk in the bottles. This method of preparation is practically that recommended by Dr. Schweinitz. The water in the pail or vessel is heated to the boiling point, the heat removed and the milk and water allowed to stand for thirty minutes, at the end of which time it is cooled.

To test this method, milk artificially infected with tuberculous material was used.

Guinea pigs, Nos. 256 and 266 were inoculated intra-abdominally with 1 c. c. each of the milk before it was pasteurized as above.

Both of these animals developed general tuberculosis in a few weeks.

Guinea pigs, Nos. 267 and 268, from bottle 1; 269 and 270, from bottle 2; and 271 and 272, from bottle 3; were inoculated intra-abdominally with 5 c. c. each after the milk had been pasteurized.

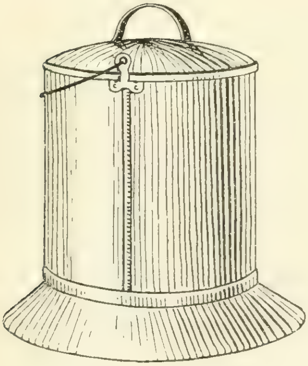
No traces of tuberculosis could be found in any of these when they were chloroformed at the time the controls 256 and 266 were examined.

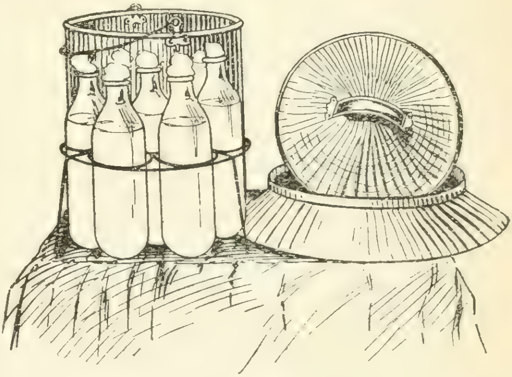
Experiment 2. The same apparatus was used as in experiment one and handled (except the heating) in the same way. This lot was heated to the boiling point, held there for five minutes, then cooled.

Guinea pigs, Nos. 279 and 280, were each inoculated intra-abdominally with 1 c. c. of the milk infected with tuberculous material before it had been pasteurized. Both contracted general tuberculosis and showed marked lesions in the lungs, liver and lymphatic glands.

Guinea pigs, Nos. 273 and 275, from bottle 1, 274 and 276 from bottle 2, and 277 and 278 from bottle 3, were each inoculated intra-abdominally with 5 c. c. of the infected milk after it had been pasteurized as above and when the controls 279 and 280 were examined, these animals were chloroformed and careful search made for tuberculous lesions. None could be detected. These two methods are evidently safe, because in each case the pasteurization killed the deadly virus. All the animals died which received the infected milk before pasteurization and none of the twelve which had received five times the amount of the pasteurized infected milk showed any trace of tuberculosis.

An apparatus which has been thoroughly tested and found to be efficient has been devised for family pasteurization of milk and is here presented. This apparatus, of course, assumed that the slightly cooked flavor and odor are not objectionable. Instead of using water as the heating medium steam is employed because of economy.





This pasteurizing apparatus was suggested by Novy's laboratory pail sterilizer, and consists of a covered pail with a perforated bottom placed upon a water bath provided with a shoulder to receive it. There is a hole in the cover so as to provide for a continuous stream of steam. Inside the pail is a rack which holds the bottles in position. The water bath is shallow and flanges out from the shoulder. By this means a large heating surface is presented and the water is soon raised to the boiling point upon the application of heat.

To use the apparatus, the bottles of milk plugged with cotton wool are placed in the rack inside the pail. While the water is reaching the boiling point, the pail cover may be used to cover the water bath. As soon as the water boils, replace the cover on the pail and then put the pail on the water bath.

For household purposes, fifteen minutes of steaming will be sufficient; for infant feeding, steam one-half hour.

The milk in the bottles reaches 90° C. (194° F.) in five minutes, a temperature that is beyond doubt in the destruction of pathogenic bacteria, even the tubercle bacillus. The method is simple and needs little attention, and will answer every purpose where milk and cream are to be used as such. The cooked flavor is so slight when the pasteurization occupies only fifteen minutes that is may soon be disregarded, unless there are digestive disorders caused by its constant use.

Where cream is to be made into butter, the more careful method of pasteurizing at 68° C. (155° F.) is recommended, because the quality of butter is not injured in the least.

To pasteurize successfully every detail should be followed carefully in the right spirit, otherwise the entire operation is worthless. Furthermore, each family should attend to its own pasteurization, if safey is to be assured. There are unscrupulous milkmen who advertise pasteurized milk without making much of an effort to see that it is done as it should be.

Remember that the pasteurization of milk has reduced the infantile mortality nearly one-half in cities where it has been practiced only in part.

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FERTILIZER ANALYSES.

BY R. C. KEDZIE, CHEMIST.

Bulletin 174.—Chemical Department.

The law providing for the inspection of commercial fertilizers and to regulate the sale thereof was enacted fourteen years ago. The full text of the law is here inserted:

SECTION 1. *The People of the State of Michigan enact,* That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer or party who causes it to be sold or offered for sale within this State, shall file with the secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State: *Provided,* That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office; together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections one, two, and three of this act, or who shall attach or cause to be attached to any such package or fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain shall, upon conviction thereof, be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

OBJECT OF INSPECTION OF COMMERCIAL FERTILIZERS.

The law does not prescribe any standard for the composition of a commercial fertilizer, the manufacturer being free to make his own standard, the law simply requiring that the fertilizers offered for sale shall be up to the standard set up by the manufacturer. The license to sell does not certify to the value of the fertilizer, but simply states that the manufacturer or dealer offers for sale a fertilizer for which a certain content of nitrogen, potash and phosphoric acid is claimed, and that samples of such fertilizers have been deposited with the secretary of the college with affidavit regarding the composition. Analysis is then made of each of these fertilizers, gathered in the open market as far as possible, and the results of such analysis published in bulletin. The *claimed* composition and *found* composition are arranged in parallel lines, so that the real composition can be compared at a glance with the composition claimed for it by the manufacturer. In this way the buyer can see at once by this bulletin whether the fertilizer is as good as the claims made for it.

RESULTS REACHED BY INSPECTION.

The quality of the fertilizers sold in this State has greatly improved within a few years past. On comparing the composition as "claimed" with that "found" by analysis, it will be seen that in only a few cases does the minimum claim exceed the amount actually found, and in many cases the amount found exceeds the highest amount claimed. The day when the mixture of leached ashes and soap-boilers' waste can be sold for superphosphate or marl palmed off for Buckeye phosphate has passed away in Michigan.

WHAT DO COMMERCIAL FERTILIZERS CONTAIN?

The first question one asks about a new article is, "What is it made of?" and the second is, "Will a material of such composition and at the stated cost, give me a profit when used on my farm?"

Commercial fertilizers contain a variety of substances, but only three of such importance that the farmer can afford to buy them at the prices charged for concentrated manures. They often contain lime, magnesia, silica, oxide of iron, sulphates, chlorides, etc., many of these of value as manures, but they can be bought for less money than is charged for the commercial fertilizers. The fertilizers may contain all these, but we buy them because they contain in addition one or more of three materials, viz., potash, phosphoric acid, and active nitrogen. It is the presence of these materials that gives commercial value to fertilizers. If the dealer boasts that his manure contains alumina, silica, oxide of iron, lime and magnesia, the sufficient answer is that these materials make up the mass of all soils, and that the farmer buys his land by the acre and not by the ton. The only manurial materials that a farmer can afford to buy at prices demanded for fertilizers are these three most necessary, most precious, and most easily exhausted elements of plant growth—the tripod of agriculture. In the absence of any one of these three materials no plant can grow to perfection, and if the supply of them is below the needs of any given plant, that deficiency limits the crop proportionally. However abundant all the other elements of plant life, nothing will make up for the lack of any one of these three substances.

LEADING KINDS OF FERTILIZERS.

The leading kinds of fertilizers may be classified as follows:

1. Complete manure, which contains nitrogen in some combination, such as a salt of ammonia, nitrate of soda, or organic nitrogen; potash, as muriate or sulphate (German Stassfurth salts) or wood ashes; and phosphoric acid as a phosphate of lime. It is called a complete manure because it contains all of the three materials most essential for plant growth, and most likely to be deficient in a field after long cropping.

2. Plain Phosphate, which may be in the form of superphosphate, soluble in water or solution of citrate of ammonia, these being called available, because they are readily taken up by the roots of plants; and ground phosphate rock, an insoluble form. The bone phosphate and rock phosphate are changed into superphosphate by the action of sulphuric acid, removing a part of the lime, as sulphate.

The soluble phosphate is especially beneficial to plants in the early stage of their growth, giving them a good start. In later stages of growth when the plant by its roots can forage for food in the soil, the insoluble phosphate may have nearly as beneficial an effect.

Phosphates promote the formation of flower and fruit and secure earlier ripening. They may wisely be used on vines and succulent fruits that are liable to be cut by early frosts in autumn, securing early crops with better prices and avoiding the loss of the entire crop by untimely frosts before the most of the crop had ripened. Fruit trees sometimes blossom year after year without producing fruit. This is often caused by storms at the period of flowering, but it may be caused by constitutional weakness, in consequence of which pollen of vital power is not formed. In such cases the use of active phosphates is worthy of trial.

3. Bone Meal contains phosphate of lime and animal matter rich in nitrogen, and hence is very valuable for manure where we desire a prolonged influence. It is well adapted to grass lands and lawns, and is free from the bad odor often given off by mixed fertilizers. Moist meadows are benefited by a dressing of bone meal. If the bones that now adorn the back yard and pasture lot should be ground into a powder and scattered on a crop-worn field, the results would surprise some farmers.

4. Potash Manure. The best and cheapest is that neglected home product—wood ashes. These contain an average of five per cent of potash, besides a sensible amount of phosphate, and a very large amount of carbonates of lime and magnesia; they are an all-round plant manure so far as mineral matter is concerned, supplying each ash element.

Unless the farmer can bring into active form the great store of potash in his soil, he will then have to buy the German potash salts, the muriate or sulphate. These salts are yearly coming into greater prominence as potash fertilizers, but their sale in Michigan in separate form has not been large.

The influence of potash on plant life is masterful; no plant can grow without it, and its influence in developing the carbohydrates, and maturing fruits, is marked and apparently controlling.

5. Nitrogen Compounds. Nitrogen is the bottled wine of the vegetable feast. If the term stimulant can be applied to any organization destitute of a nervous system, then nitrogen is the stimulant of plant life. In any of its combined forms it gives depth of color and exuberance of growth to vegetable life, and when in abundant supply it causes the plant to break forth into riotous growth. The great reservoir of nitrogen is the air, but the leaves of plants though constantly bathed in nitrogen, cannot drink in a particle. It is only *nitrogen in combination* that can be appropriated by the plant, and this enters the plant by the roots and comes from the soil. A small amount is brought to the soil by the rain, washing out the ammonia and nitrates of the air, but the amount is not large, and entirely inadequate to supply a crop.

A large amount of active nitrogen in the form of nitrates is yearly formed in every well cultivated field, and this is the cheapest way of securing a supply of this costliest element of plant growth. The raising of leguminous crops, like the clovers, is the next cheapest way of securing a supply.

Combined nitrogen is purchased in three forms; salts of ammonia, nitrate of soda, and organic nitrogen in the form of dried blood, fish scraps, cotton seed meal, etc.

6. Tankage, is a complex and variable material obtained from the waste residues at the slaughter houses, the garbage collected by the scavengers in cities, etc. These materials are dried, the grease extracted in tanks and this tankage by itself, or mixed with phosphates, potash, etc., is sold as a fertilizer. It is mainly used to give bulk to the concentrated fertilizers made from bone and rock phosphate.

LIME.

Following nitrogen, potash and phophoric acid, the next most important material is lime. In soils made by the decomposition of granite rocks, the soil is apt to be deficient in lime. This is manifest in the New England states. In most counties of our lower peninsula, where the soil is classed in the drift formation, lime is an abundant element in the soil. It is easy to determine this by an examination of the well water. Our water comes by the rain and is soft, but soaking into the ground it dissolves more or less of the mineral matter of the soil. If the well water of any region is *very hard* as shown by its action on soap, the hardness being caused by the lime dissolved in the water, such soil contains enough lime to supply the needs of crops. Lime may be used in such regions to decompose muck and flocculate clay, but is not required to feed the crops.

SCHEDULE OF COMMERCIAL PRICES.

The following prices per pound for fertilizing materials may be used in estimating the commercial value:

	Per pound.
Nitrogen in nitrates	13 cents
Nitrogen in ammonia salts	14 cents
Organic nitrogen in meat, blood, etc	14 cents
Organic nitrogen in fine bone and tankage	13½ cents
Organic nitrogen in medium bone and tankage	10 cents
Organic nitrogen in course bone and tankage	8 cents
Phosphoric acid, available	4½ cents
Phosphoric acid, insoluble, in fine bone and tankage	4 cents
Phosphoric acid, insoluble, medium bone and tankage	3½ cents
Potash as muriate	4½ cents
Potash as sulphate and in wood ashes	5 cents

In the table of analysis the results are given as so many parts in a hundred.

Since there are 20 times 100 pounds in a ton, if we multiply the value of one pound by 20 we find the value of one per cent of any material in a ton. We may thus construct a table for estimating the value of any materials found in the results of analysis. One per cent means 20 pounds in a ton, and if the material is worth 5 cents a pound, then each per cent equals $1.00 for a ton.

COMMERCIAL VALUE AND AGRICULTURAL VALUE.

The commercial value and the agricultural value are not identical. The commercial value merely represents the cost of the material to make the fertilizer, if any one should attempt to make his own. The agricultural value of the benefit from the use of such fertilizer will depend upon a variety of conditions, such as the kind of soil, the crop, the season, the tillage, time of application, etc., etc. Let no one suppose that the estimate of the commercial value is a guarantee of a corresponding profit by its use on the farm. It may serve, however, as a basis of comparison between different brands of fertilizers. The reliable test of the value is determined by its use on a given soil and crop—worth more than all theoretical discussions and deductions. Yet there are certain general considerations which go to show the probable benefit of any fertilizing element when used on a certain kind of soil and crop, which will be of some benefit in selecting a fertilizer.

TERMS EXPLAINED.

In the table giving the results of analysis of commercial fertilizers there are certain terms used which require explananion: "Available nitrogen, estimated as ammonia;" under "Phosphoric acid" the terms "Available P_2O_5;" "Insoluble P_2O_5;" "Total P_2O_5" and "Potash soluble in water, estimated as K_2O."

Nitrogen may exist in available form either as a salt of ammonia, a nitrate, or in organic material such as dried blood, and be equally valuable in these several forms. But for ease of comparison in different manures chemists estimate it as if all these forms of nitrogen existed in the form of ammonia. Chemists estimate the compounds of phosphorus in manures as anhydrous phosphoric acid, P_2O_5; that is, phosphoric acid deprived of water; when this anhydride combines with water, the acid is formed. Thus if three molecules of water are added to one of P_2O_5 two molecules of phosphoric acid are formed $3H_2O + P_2O_5 = 2H_3PO_4 =$ phosphoric acid. The P_2O_5 in separate form does not exist in any soil, but this expression is chosen because the amount of this combination of phosphorus is easily indicated, without considering what material the acid may be combined with. "Available P_2O_5" signifies the per cent of the acid in a form directly usable by the plant: "Insoluble P_2O_5," the per cent of acid in the condition of phosphate rock. By adding together the "Available" and "Insoluble" we get the "Total P_2O_5."

The "Potash soluble in water, estimated as K_2O, is the soluble potash salt estimated only as regards the oxide of potassium=K_2O=oxide of kalium or potassium.

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Armour & Co., Chicago, Ill.	Bone, Blood and Potash	Mohr Hardware Co., West Bay City
Armour & Co., Chicago, Ill.	Bone Meal	Farmers' Elevator Co., Lenox
Armour & Co., Chicago, Ill.	Grain Grower	T. McClaughry, Romulus A. R. Hahn, Utica
Armour & Co., Chicago, Ill.	All Soluble	Farmers' Elevator Co., Lenox
Armour & Co., Chicago, Ill.	Ammoniated Bone with Potash	T. McClaughry, Romulus
Armour & Co., Chicago, Ill.	Fruit and Root Crop Special	Mohr Hardware Co., West Bay City
Armour & Co., Chicago, Ill.	Star Phosphate	Manufacturer
Armour & Co., Chicago, Ill.	Phosphate and Potash	M. & J. McLauchlin, Jackson
Armour & Co., Chicago, Ill.	Wheat, Corn and Oats Special	M. & J. McLauchlin, Jackson
James Boland, Jackson, Mich.	Blackman	Jas. Boland, Jackson
Bradley Fertilizer Co., Boston, Mass.	Dissolved Bone with Potash	J. A. Cozadd, Wayne
Bradley Fertilizer Co., Boston, Mass.	Niagara Phosphate	J. A. Cozadd, Wayne
Bradley Fertilizer Co., Boston, Mass.	Potato and Root Phosphate	Richmond Elevator Co., Lenox
Bradley Fertilizer Co., Boston, Mass.	Dissolved Bone, "Justice Brand"	W. M. Hart, Smith's Creek
Bradley Fertilizer Co., Boston, Mass.	B. D. Sea Fowl Guano	W. M. Hart, Smith's Creek
Bradley Fertilizer Co., Boston, Mass.	Alkaline Bone and Potash	W. M. Hart, Smith's Creek

for 1899, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.
		Available.	Insoluble.	Total.	
Claimed	5 to 6	8 to 10	1.5 to 2.5	9.5 to 12.5	7 to 8
Found	4.65	9.35	1.70	11.05	9.19
Claimed	3 to 4			24 to 28	
Found	4.19	9.93	12.93	22.86	
Claimed	2 to 3	8 to 10	1.5 to 2.5	9 to 12.5	2 to 3
Found	2.17	10.18	2.93	13.11	2.50
Claimed	3.5 to 4.5	8 to 10	1.5 to 2.5	9 to 12.5	4 to 5
Found	4.19	8.38	6.02	14.40	2.55
Claimed	3 to 4	6 to 8	1.5 to 2.5	7.5 to 10.5	2 to 3
Found	3.81	5.59	5.84	11.43	2.46
Claimed	2 to 3	8 to 10	1.5 to 2.5	9 to 12.5	5 to 6
Found	3.52	9.25	3.28	12.53	7.55
Claimed		12 to 16	2 to 3	14 to 19	
Found		16.34	2.07	18.41	
Claimed		10 to 12	2 to 3	12 to 15	2 to 3
Found		12.91	3.87	16.78	1.87
Claimed	1 to 2	8 to 10	1.5 to 2.5	9.5 to 12.5	1 to 2
Found	1.80	8.97	3.47	12.44	2.05
Claimed	1.14	3.86	2.06	5.94	2.51
Found	1.01	1.95	4.10	6.05	4.16
Claimed	1 to 2	8 to 10	2 to 3	10 to 13	2.15 to 3.25
Found	1.61	8.20	2.76	10.96	2.05
Claimed	1 to 2	7 to 9	1 to 2	8 to 11	1.08 to 1.65
Found	1.44	7.98	2.70	10.68	1.25
Claimed	1 to 2	8 to 10	2 to 3	10 to 13	3 to 4
Found	1.54	8.49	2.61	11.10	2.75
Claimed		12 to 15	1 to 2	13 to 17	
Found		12.51	2.29	14.80	
Claimed	2.5 to 3.5	8 to 10	2 to 3	10 to 13	1.5 to 2.5
Found	2.70	8.57	4.13	12.70	1.28
Claimed		11 to 13	1 to 2	12 to 15	2.43 to 3.50
Found		11.07	2.09	13.16	2.28

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Chicago Fertilizer Co., Chicago, Ill.	Bone, Blood and Potash	Geo. B. Terry, Dryden
Cleveland Dryer Co., Cleveland, Ohio	Potato, Tobacco and General Crop	R. T. Knight, Pontiac
Cleveland Dryer Co., Cleveland, Ohio	XXX Phosphate and Potash	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Phospho Bone	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Horsehead Phosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	XXX Superphosphate	R. T. Knight, Pontiac
Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker and Potash	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker	R. T. Knight, Pontiac
Crocker Fertilizer Co., Buffalo, N. Y.	General Crop Phosphate	H. W. Harvey, Utica
Crocker Fertilizer Co., Buffalo, N. Y.	Sugar Beet Manure	C. Goddeyne, Bay City
Crocker Fertilizer Co., Buffalo, N. Y.	Special Sugar Beet Fertilizer	C. Goddeyne, Bay City
Crocker Fertilizer Co., Buffalo, N. Y.	New Rival Ammoniated Superphosphate	Michigan State Chicory Co., Bay City
Crocker Fertilizer Co., Buffalo, N. Y.	Universal Grain Grower	W. H. Harvey, Utica
Detroit Sanitary Works, Detroit, Mich.	Clover Leaf	Wm. Green, Wayne
Detroit Sanitary Works, Detroit, Mich.	Superior Potato	Wm. Green, Wayne
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Club and Grange Formula	J. M. Preston, Macomb
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Potato, Tobacco and Truck Manure	H. A. Miller, Beddow
Farmers' Union Fertilizer Co., Buffalo, N. Y.	Standard Phosphate	H. A. Miller, Beddow

for 1899, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.
		Available.	Insoluble.	Total.	
{ Claimed { Found	1.83 to 3.04 3.03	9 to 12 10.16	1 to 2 5.61	10 to 14 15.77	2 to 4 5.26
{ Claimed { Found	1.25 to 2.5 1.66	10 to 12 10.14	1 to 2 2.85	11 to 14 12.99	6 to 7 5. 18
{ Claimed { Found	--------- ---------	12 to 14 11.98	--------- 1.87	--------- 13.85	5 to 6 4 69
{ Claimed { Found	1 to 2 1.26	10 to 12 11.62	--------- 2.82	--------- 14.44	1 to 1.5 1. 23
{ Claimed { Found	--------- ---------	10 to 12 11.21	--------- 3.06	--------- 14.27	--------- ---------
{ Claimed { Found	--------- ---------	13 to 15 12.81	--------- 2.39	--------- 15.20	--------- ---------
{ Claimed { Found	2 to 3 2.32	10 to 12 9.64	--------- 3.10	--------- 12.74	2 to 3 1. 43
{ Claimed { Found	2 to 3 2.00	10 to 12 9.72	--------- 3.69	--------- 13.41	--------- ---------
{ Claimed { Found	1 to 2 1.25	7 to 10 7.02	1 to 2 2.29	8 to 12 9.31	1.08 to 2. 5 1.31
{ Claimed { Found	1.5 to 2.5 1.67	7 to 9 7.05	1 to 2 1.96	8 to 11 9.01	1.5 to 2.5 3.35
{ Claimed { Found	2.5 to 3.5 2.89	8 to 10 7.18	1 to 2 2.96	9 to 12 10.14	4.5 to 5.5 5.05
{ Claimed { Found	1.5 to 2.5 1.90	10 to 12 9.63	1 to 3 2.31	11 to 15 11.94	1.6 to 3.0 1.59
{ Claimed { Found	1 to 2 1.21	7 to 10 8.25	1 to 2 1.83	8 to 12 10.08	2.7 to 4 2.96
{ Claimed { Found	3.34 to 4.25 2.92	6 to 9 8.81	1 to 3 2.07	7 to 12 10.88	2.70 to 3.5 3.59
{ Claimed { Found	4.25 to 5.45 3.75	6 to 8 7.64	1 to 3 2.01	7 to 11 9.65	4 to 5 4.92
{ Claimed { Found	1 to 2 1.40	8 to 10 8.03	1 to 2 2.40	9 to 12 10.43	1.08 to 2.16 1.11
{ Claimed { Found	2.25 to 3.25 2.58	9 to 11 8.92	1 to 2 2.11	10 to 13 11.03	4 to 5 3.83
{ Claimed { Found	1.5 to 2.50 1.56	9 to 11 9.59	1 to 2 2.35	10 to 13 11.94	2 to 3 1.68

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Farmers' Union Fertilizer Co., Buffalo, N. Y	Dissolved Bone and Potash	Manufacturer
Jarecki Chemical Co., Sandusky, Ohio	Dissolved Bone Black Wheat Special	T. McClaughry, Romulus
Jarecki Chemical Co., Sandusky, Ohio	Fish and Potash Tobacco and Potato Food	J. H. McMann, Richmond
Jarecki Chemical Co., Sandusky, Ohio	Fish and Potash Grain Special	R. C. Bialy, Bay City
Jarecki Chemical Co., Sandusky, Ohio	Lake Erie Fish Guano	R. C. Bialy, Bay City
Jarecki Chemical Co., Sandusky, Ohio	C. O. D. Phosphate	Manufacturer
Jarecki Chemical Co., Sandusky, Ohio	Number One Fish Guano	R. C. Bialy, Bay City
Lister Agricultural Chemical Co., Newark, N. J.	Success	A. R. Hahn, Utica
Michigan Carbon Works, Detroit	Red Line Complete Manure	Jenison Hardware Co., Bay City Schneider & Reindel, Frazer
Michigan Carbon Works, Detroit	Red Line Crop Grower	Schneider & Reindel, Frazer
Michigan Carbon Works, Detroit	Homestead, a Bone Black	Schneider & Reindel, Frazer
Michigan Carbon Works, Detroit	Red Line Phosphate with Potash	Richmond Elevator Co., Lenox
Michigan Carbon Works, Detroit	Homestead Potato Grower	Richmond Elevator Co., Lenox
Michigan Carbon Works, Detroit	Homestead Lawn Fertilizer	A. J. Brown Seed Co., Grand Rapids
Michigan Carbon Works, Detroit	Red Line Ammoniated Phosphate	Manufacturer
Michigan Carbon Works, Detroit	Banner Dissolved Bone	Manufacturer
Michigan Carbon Works, Detroit	Homestead Sugar Beet Fertilizer	Farm Department M. A. C.
Niagara Fertilizer Co., Buffalo, N. Y.	Wheat and Corn Producer	T. McClaughry, Romulus

for 1899, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.
		Available.	Insoluble.	Total.	
Claimed		8 to 10	1 to 2	9 to 12	2 to 3
Found		7.58	1.84	9.42	2.72
Claimed		16 to 18	1 to 2	17 to 20	
Found		15.03	1.89	16.92	
Claimed	1 to 2	9 to 10	1 to 2	10 to 12	4 to 5
Found	1.33	9.73	2.06	11.79	4.77
Claimed	1.45 to 1.95	9 to 10	1 to 2	10 to 12	4 to 5
Found	1.76	9.37	3.05	12.42	3.10
Claimed	2 to 3	10 to 12	1 to 2	11 to 14	1 to 2
Found	2.00	9.48	3.65	13.13	1.35
Claimed		14 to 15	1 to 2	15 to 17	
Found		14.59	3.43	18.02	
Claimed	1 to 2	10 to 12	1 to 2	11 to 14	1 to 2
Found	1.66	8.73	4.51	13.24	.75
Claimed	1.5 to 2	9.5 to 11	2 to 3	11.5 to 14	2 to 3
Found	1.89	9.73	1.97	11.70	2.19
Claimed	1.28 to 2.25	8 to 10			1.5 to 2.5
Found	1.72	9.14	1.73	10.87	1.55
Claimed	2 to 3	8 to 10			2 to 3
Found	2.16	8.42	1.55	9.97	2.24
Claimed	2.75 to 3.5	9 to 12	.5 to 1.5	9.05 to 13.5	1.75 to 2.5
Found	2.96	10.19	.73	10.92	2.71
Claimed		10 to 12			3 to 4
Found		10.63	1.47	12.10	4.73
Claimed	2.35 to 3.25	8.5 to 10			5 to 6
Found	2.98	9.49	.81	10.30	5.83
Claimed	3.36 to 3.94	11 to 13			2 to 2.5
Found	3.13	9.10	.46	9.56	3.84
Claimed	2 to 3	8 to 10			
Found	2.45	8.77	2.19	10.96	
Claimed		30 to 34			
Found		33.63	3.33	36.96	
Claimed	1.5 to 2	7 to 9	.5 to 1.5	7.5 to 10.5	5 to 6
Found	2.09	8.20	.35	8.55	4.99
Claimed	1.5 to 2.5	8 to 10	1 to 2	9 to 12	2.16 to 3.24
Found	1.87	7.36	3.32	10.68	2.25

Results of analysis of commercial fertilizers

Manufacturer.	Trade name.	Dealer and locality.
Niagara Fertilizer Co., Buffalo, N. Y	Grain and Grass Grower	Stafford & Shoesmith, Romeo
Northwestern Fertilizer Co., Chicago, Ill	Pure Ground Bone	C. B. Waterloo, Port Huron
Northwestern Fertilizer Co., Chicago, Ill	Garden City Superphosphate	Farmers' Elevator Co., Lenox
Northwestern Fertilizer Co., Chicago, Ill	Raw Bone and Superphosphate Mixture	C. C. Van Doren, Adrian
Northwestern Fertilizer Co., Chicago, Ill	Acidulated Bone and Potash	C. B. Waterloo, Port Huron
Northwestern Fertilizer Co., Chicago, Ill	Acidulated Bone	C. B. Waterloo, Port Huron
Northwestern Fertilizer Co., Chicago, Ill	Potato Grower	C. C. Van Doren, Adrian
Northwestern Fertilizer Co., Chicago, Ill	Corn and Wheat Grower	C. B. Waterloo, Port Huron
Ohio Farmers' Fertilizer Co., Columbus, Ohio	Ammoniated Bone with Potash	Schneider & Reindel, Frazer
Ohio Farmers' Fertilizer Co., Columbus, Ohio	Corn, Oats and Wheat Fish Guano	Schneider & Reindel, Frazer
Ohio Farmers' Fertilizer Co., Columbus, Ohio	Soluble Bone and Potash	Schneider & Reindel, Frazer
Emery J. Smith & Co., Columbus, Ohio	Ammoniated Bone and Potash	Manufacturer
Speidel & Schwartz, G'd Haven, Mich	Celery Hustler	Speidel & Schwartz, Grand Haven
Williams & Clark Fertilizer Co., Cleveland, Ohio	Prolific Crop Producer	Geo. L. Frank, West Bay City
Williams & Clark Fertilizer Co., Cleveland, Ohio	Dissolved Bone and Potash	Geo. L. Frank, West Bay City
Williams & Clark Fertilizer Co., Cleveland, Ohio	Royal Bone Phosphate	Geo. L. Frank, West Bay City

for 1899, expressed in parts in a hundred.

	Available nitrogen. Estimated as ammonia.	Phosphoric acid.			Potash soluble in water, estimated as K_2O.
		Available.	Insoluble.	Total.	
Claimed	1 to 2	7 to 9	1 to 2	8 to 11	1.08 to 2.16
Found	1.68	8.31	2.69	11.00	1.91
Claimed	3 to 4			18 to 22	
Found	4.48	4.66	16.49	21.15	
Claimed	2.5 to 3	8 to 9	4 to 4.5	12 to 13.5	.54 to 1.08
Found	3.22	8.27	3.79	12.06	.77
Claimed	3 to 3.5	7 to 8		14 to 16	.54 to 1.08
Found	3.98	8.06	7.59	15.65	.86
Claimed	1 to 2	10 to 12	2 to 3	12 to 15	1.5 to 2
Found	1.10	10.04	4.17	14.21	1.27
Claimed	1 to 2	10 to 12	2 to 3	12 to 15	
Found	1.25	10.10	2.85	12.95	
Claimed	3 to 4	8 to 10	2 to 3	10 to 13	2 to 2.5
Found	3.15	8.97	1.96	10.93	1.69
Claimed	2.5 to 3	10 to 12	2 to 3	12 to 15	1 to 1.5
Found	2.52	10.03	3.70	13.73	.88
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	4 to 6
Found	1.72	6.85	1.33	8.18	4.21
Claimed	1.5 to 2.5	9 to 11	1 to 2	10 to 13	2 to 4
Found	1.42	12.07	2.23	14.30	1.69
Claimed		12 to 14	1 to 2	13 to 16	1 to 2
Found		12.15	1.46	13.61	1.74
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	1 to 2
Found	1.72	8.91	12.08	20.99	4.48
Claimed	8.15 to 9.68			3.17 to 3.40	1.25 to 2.5
Found	8.02	2.48	1.41	3.84	1.56
Claimed	1 to 2	5 to 6	1 to 2	6 to 8	1 to 2
Found	1.45	8.63	2.61	11.24	1.32
Claimed		9 to 11	1 to 2	10 to 13	2 to 3
Found		10.17	2.50	12.67	1.71
Claimed	1.25 to 2	6 to 7	1 to 2	7 to 9	2 to 3
Found	1.57	8.90	3.43	12.33	2.02

COMMENCEMENT EXERCISES.

COMMENCEMENT DAY—FORTY-SECOND SESSION MICHIGAN AGRICULTURAL COLLEGE, JUNE 16, 1899, 10:00 A. M.

PROGRAM.

MUSIC.

Invocation.

Music. "The Toll." A. Stone

Misses Newell and Parker.
Messrs. Hayes and Gingrich.

Address, "Science and Agriculture,"
S. L. Ingerson, representing the Agricultural Course.

Address, "The Women's Club Movement,"
Miss T. A. Bristol, representing the Women's Course.

Music. Polonaise, C. Sharp Min. Chopin

Mrs. C. E. Marshall.

Address, "The Law of Equipoise,"
President A. S. Draper of the University of Illinois.

MUSIC.

Presentation of Awards in contest of June 9.

Rev. C. F. Swift.

Conferring of Degrees.

GRADUATING CLASS.

R. Maning Agnew,
Clift F. Austin,
Marie Belliss,
Teresa A. Bristol,
Joseph A. Bulkeley,
Charles E. Calkins,
Fred R. Crane,
S. F. Edwards,
Walter H. Flynn,
Edward D. Gagnier,
George N. Gould,
William D. Hurd,
Seymour L. Ingerson,
Charles Johnson,
W. Roscoe Kedzie,
Adorf B. Krentel,
Christian M. Krentel,
Macy H. Lapham,
Fred N. Lowry,
James L. McDermott,
P. S. Rose,
John Severance,
Allan H. Stone,
A. Thorne Swift,
Francis E. West,
Fay Wheeler.

ADDRESS OF PRESIDENT SNYDER TO GRADUATING CLASS.

Ladies and Gentlemen of the class of '99:

It gives me great pleasure to be able to congratulate you on the successful completion of your College courses.

In looking back the four years seem to have vanished almost as in a night. There has of necessity been much in your College course of hard work, which has meant long hours and weary nights. There have no doubt also been much disappointment and discouragement, yet it is to be hoped that you will be able to forget all that which was not pleasant in your work and remember only the joyful hours, the conquests made, the victories won, and the friendships formed, many of which will not be broken in this life. You will never again make friends which will be to you what your College friends have been.

There perhaps comes to many of you today a feeling of disappointment and sadness. How different your feelings today from that which you anticipated they would be when you entered upon your courses. You are not able to recall and classify the results of your hard study as you thought you could. You do not have the self-confidence that you felt sure that you would have when you should reach your graduation day.

The youth when entering College usually looks forward to his graduation day as the time when he shall reach the summit and shall with hope and renewed confidence enter upon the duties of life. But when he has reached this height he realizes that he has just begun. Above and beyond are other heights which he must ascend before he can reach the goal of his ambition. And thus is he led on from summit to summit, with each ascent his horizon broadening until he ascends the last mount and is called home. And if today you to some extent feel a disappointment at your meagre attainment, for all our attainments are meagre, you are simply repeating the experiences which have come to most of those who have preceded you.

This feeling of disappointment, if such you have, should not discourage you. That you are here today is sufficient evidence that you have made a success of your College work. It is also a sufficient guaranty that you can succeed in your life work whatever that may be. Your battle is not won, but it is begun, and for you very favorably begun. You have a right to entertain high hopes for the future. Yes, it is your duty to have a high regard for self, and an implicit confidence in your ability to conquer in all the battles of life. With every conquest will come new strength. Go forward then with all the vigor of young manhood and womanhood to make a success of life. But, let me caution you to be very careful in forming your ideals of what constitutes real success. It may be the accumulation of wealth, but not if this gain is made by sharp and doubtful practices; by taking advantage of the misfortunes of others, or by following any occupation or calling which will not give free scope to the development of all the higher power of body, mind and soul.

Success may come in the form of promotions to positions of honor, and trust at the hands of the people, but never if brought about by double dealing, by purchasing votes with either money or insincere pledges, or by any other practice or method that would make you blush to see in print.

There are as many roads to success as there are directions from a given point. Many lead along the highways of fame and fortune, while others follow the well trodden paths of poverty and obscurity.

Your life will be what you make it. If you are true at all times to your higher nature, to that which your better self tells you is right, your life will be a success in whatever calling or occupation spent, and when the end comes you will realize that the consciousness of a life well spent is most delightsome.

Your record, as far as your College life is concerned, has been made. In addition to the record which you have made upon the College books you made for yourselves records, which are written on the hearts of your teachers and fellow students. These records are a fairer and more comprehensive estimate of your real worth than per cents or figures put down upon paper. Every day's work, thought and motive will add to this record. In view of the education and training which you have received, may I not entreat you to make this record worthy of your Alma Mater, which stands ready to give you encouragement and aid in any laudable undertaking, and which in turn hopes to merit your loyal support? May I not entreat you to make a record worthy of the State and Nation whose liberality has given you so many educational advantages? May you at all times show your appreciation of these special privileges and ever support and uphold the dignity of the laws of this Nation and commonwealth.

We bid you farewell with the assurance that our eyes shall follow you, expecting much and with the prayer that your record, which in the nature of the case will be indelible, may have your own approval in your best moments; may be clean and clear and Christlike.

GREAT OPPORTUNITIES IN A GREAT AGE.

BACCALAUREATE SERMON BY PRESIDENT JOHN HENRY BARROWS, D. D., OF OBERLIN COLLEGE, BEFORE THE MICHIGAN AGRICULTURAL COLLEGE, JUNE 11, 1899.

Text, Psalms 8: 5-6.

Marvelous has become the mastery achieved by man over material things. The tiger walks the Indian jungle, proudly conscious of power to attack and defend. The lion has his tooth and terrible paw, and is king over beasts. But in man is the spirit of God, and therefore, all obey him. The monsters crawl at his feet, subdued. He moves his wand and magnetic wires murmur through a thousand leagues of sea the intelligible speech of nations. At his touch deserts become gardens, mountains are leveled or pierced, and continents girded with iron. He yokes the tides of the moon to his mill wheel, and bids the strong earth by gravitation turn his mill spindles. He magnifies his vision so as to peer into atoms and star depths. No ape or elephant ever invented a microscope or took out a patent for a mowing machine. Man only is lord over nature. He only can till the earth and subdue it, and call forth its hidden forces and possibilities. On him only the giants and the fairies wait. For him "the diving-bell of memory," as Emerson has said, "descends into the deeps in our past and oldest experience, and brings up every lost jewel." For him imagination turns every dull fact into picture and poetry by making it the symbol of a thought. Every resplendent fact of our intellectual natures is a shining finger pointing not to the star dust, but to him who steppeth enthroned above the stars, whom we call our Father in Heaven.

However wonderful the mastery over nature thus far achieved by man, we are confident that the twentieth century will witness still more surprising achievements. We live in an age of wonders. Steam and electricity are bringing the nations closer together. Each land shares in the treasures of other lands. Commerce is doing magnificent service in drawing peoples toward each other. Such is the perfection of travel that one may aim for a city in the East or Far East, and strike it within five minutes of the time set down in the steamship's itinerary. Men are sharing similar ideas and hopes. The doctrines of divine fatherhood and human brotherhood have gone out far beyond the bounds of Christendom. The richest thoughs of men are more unified than ever before. Christ has become the commanding center in the world of religion. The nearer men get to him the nearer they get to each other.

Among the wonders of our time has been the sudden emergence of America into the rank of world powers. Only a year has passed since Admiral Dewey anchored Asia off our Western shores. New responsibilities have been thrust upon us. New opportunities open out before us in all directions. Where are to be trained the scientists, teachers, engineers, diplomatists, missionaries, demanded by the needs of the twentieth century? Doubtless in the higher schools of our country. And there is no more promising sign of our times than the vastly increased devotion to the higher education. Never before were such appropriations made by states and private individuals for the Colleges of the country. Never were such gifts made to libraries. Almost every poor boy of our country has educational opportunities open to him which were denied to princes and nobles in the sixteenth century. We need a thoroughly educated people, and we need highly trained minds, and strong, virtuous characters in order that we may meet the responsibilities pressing upon us. We have heard much in the last year of the man who stood behind the gun; and we have applauded the training given by our naval service. The men who are to man the guns of civilization in the coming century require the best training of all the ages. But there is no training that equals in importance that of character. Religion is not outgrown. Christianity is the supreme manifestation of religion. My studies and observations in the Orient have convinced me that the best treasure which America clasps to her bosom is that religion which shows God seeking with redemptive purpose after man, and not man groping blindly through mists of error, after God. Christianity is the religion of reason and redemption, of hope, brotherhood, and progress. It is not a rubbish heap of out-worn superstitions. It is the mountain of God's truth and God's love.

We should be exultant rather than depressed. What are to be the inevitable results of America's becoming an Asiatic power? Besides a desirable increase of our naval and military strength, an increase which would promote peace and not war, new moral responsibilities have come to us, and a new sense of old responsibilities. Every American missionary in Asia from whom I have heard in recent months has thanked God that the American flag has entered the Far East. Better government will come to the Philippines, toleration will for the first time be established, education and spiritual Christianity will do their uplifting work, and America, standing in the gates of the Far East, will more and more be a factor in the regeneration of Asia. Our position will bring us into closer alliance, as the years go by, with Great Britain. We shall have our part in the great work of the twentieth century, the civilizing of Eastern nationalities; America, forced out of her isolation, will be compelled also to counteract the inferior forms of European life which threaten to become dominant. America and Great Britain will see to it that China is not Russianized. I expect confidently that American wealth will find some of the largest and noblest fields of philanthropy in the Asiatic world.

But furthermore, America must become in a higher degree self-respecting. We must achieve better government. We must show that the character and efficiency displayed by our navy are not confined to the navy. The spoils system in all its infernal ramifications must be made odious. The civil service must be elevated. That consular and diplomatic service must be vastly improved. National expansion must be accompanied by national purifiaction. The people are learning the meaning of our new position and its obligations. It is significant that the most vigorous practical reformer of recent years has just been chosen governor of New York. England's expansion abroad has been contemporaneous with improved government at home. So let it be with us. Our colonies must not be handed over to politicians and our cities must not be ruled by bosses. The best campaigning begins when elections are over. Now is the time to strike the chords of a true patriotism. God has given us a new opportunity, a new leverage, a new outlook. Those who find God in our past are generally inclined to believe that he is in our present, and that not politicians and newspapers, but God himself, has brought us to the position we are now in. With the dawn of the twentieth century we should feel that a true Americanism is gaining ground everywhere. An appropriate watchword for that century is this: Let the Greater be also the Better America!

THE LAW OF EQUIPOISE.

COMMENCEMENT ADDRESS BY PRESIDENT A. S. DRAPER OF THE UNIVERSITY OF ILLINOIS.

From College halls you turn your faces to a busy world, a world throbbing with energy and spirit, in which the pleasures are innumerable and the contentions hard, and in which the balanced men and women gather the largest fruits. You wonder what it contains for you.

The world sets up different standards of success, but by no one of them will you succeed in equal measure. We may safely say, from the world's experience, that some of you will exert a greater influence and gain a richer share of the world's esteem than others. We know that by every standard of right living some of you will make more of life for yourselves and for all about you than others will, but we also know that no one can yet tell which of your number they will be.

God has created the world in equipoise, and that life will become the richest, will reach the farthest and accomplish the most, which obeys the laws of the Almighty and stands in harmonious relations with the universal plan. The sun and the planets and their moons, the star-suns of other systems, all balance one another in eternal and infinite space. And as in illimitable distance and with other worlds, so with the globe on which we live. The days and the seasons alternate steadily. Temperature and precipitation average alike. The tides rise and fall. The rivers run to the sea but "unto the place from whence the rivers come thither they return again." "The wind whirleth about continually and the wind returneth again according to his circuits." The soils are decaying as well as producing. The paths of nature run into themselves again. Matter moves in cycles and under the law of equipoise.

And the great movements of matter, the great periodic forces of nature, seem to bear strong relations with the greatest phenomena in life. The turning of the earth upon its axis, the circuits of the earth about the sun and of the moon about the earth, seem to fix the periodicity of the most vital changes in the world's life.

And as with matter and with motion and with life, so with thought. The history of our race, which has been made and written by the world's thought, is but the record of affairs moving in great cycles of time. There has been an ebb and flow in the great tide of human thought. Civilizations have come and gone. Governments have arisen and perished. Marked advances in knowledge and skill have been followed by marked depressions. Great waves of human sympathy and great outbursts of human passion have alternated. Peace and war have followed each other.

The world is at peace if the nations are in equipoise. When the white squadron is manoeuvring for holiday show, the merchantmen are giving reward to thrift, and plenty to millions, by equalizing the distribution of the products of the world. When the armies are idle the arts and sciences are promoting the higher physical and intellectual life of Christendom. But the periodical renewal of the Eastern question, a faint clash of arms which can scarcely be heard across the blue waters of the Mediterranean, threatens the national equilibrium of Europe and leaves a mark upon the stock board of every market in the world. I am not saying, for I do not think, that wars are not in the eternal plan. Disturbances of equilibrium work disaster and destruction in the world of matter, and sorrow and suffering in the world of thought. The apparent irregularity of a planet indicated the presence and led to the discovery of another planet, however, and so proved the inviolability of the universal law.

But there is something stupendously grand and awfully solemn about this unceasing, onward, balanced, periodic, rythmic motion of everything in matter and every energy of life. We are fools if we do not see that it is all under the control of a power above and outside of ourselves, and all pursuant to the dictates of an universal law. If it is grand and solemn when we see that all created things are obedient to a law that is broader and higher than the universe, it is still more so to realize that we should face chaos and abandon hope in the absence of such law. In the very fact that the routine is unceasing and progressive we find satisfaction and inspiration. It opens to our weak vision the uncertain road of human progress. It gives confidence in a higher destiny and strengthens the purpose to train for it.

If all matter and all energy, and all thought, are subject to God's omniscient law of equipoise and advancement, it is certain that a single being cannot hope to be successful, even in the small things of this life, and disregard it.

Individuals who start from the same point, with even opportunities and purposes equally correct, come out at very different ends. Few mark out a precise roadway in life and no one precisely follows the road which his mind may have outlined. There are elements in ourselves which we do not know and cannot estimate, and time will find us in environing conditions which time alone can reveal. Plans will miscarry and expectations be disappointed. At no time in life can we decide with entire confidence what is most desirable in the future. It is said that in early life General Grant cherished the hope of becoming a physician, and always regretted that the hope was not realized. The fact is, we cannot see and we do not know about things in advance of us. Failure to accomplish an undertaking has more than once opened the way for something of vastly more importance. Many lives are barren of results because many men insist upon predicating present action upon events which are a long way in the future and which they cannot foresee. They are so cautious, or so cowardly, that they accomplish nothing. We are to make the best plans we can, seek to make every cycle of our lives an advance upon the last one, and take with composure whatever may come to us.

Find the point of equipoise between seeing and aiming and doing. Some spend their lives in gaping; others aim high but seldom mutilate the target; still others are always doing without looking or aiming, and of course they are always blundering. To me the most trying ones of all are those who mean well and do ill continually, as some good people seem prone to do. Some men deliberate so wisely and so long that they never get to the point of exercising their energies, and the powers which make for advancement shrink to the vanishing point for lack of use. Some look wise and say little, and though they are dreadfully trying at times it must be confessed that others would fare better and be less trying by following their example. The life that accomplishes things is the one that has ideals, sees with what eyes it has, exercises the judgment it possesses within the limits of time which the occasion allows, and then plunges into action. And the life that accomplishes the most things and the best things is the one that has the noblest ideals, is trained to the greatest acuteness of vision, is capable of the most rational reasoning, has the greatest courage and force of execution, and above all is able to keep these high endowments in equilibrium.

Live in harmonious and enthusiastic relations with your work. There is work of some sort for everyone to do. If one has not adjusted himself to some kind of work there is something the matter. We may not find work exactly to our liking; indeed there are people who find it difficult to fall in love with any kind of work. But you will be at fault if you do not in a little time find congenial employment.

Do the work that comes to your hands, and assume other and yet other things to do. Dwell not so much upon the wages as upon the health and knowledge and skill to do more and better work. The rewards will take care of themselves more safely than in the case of the man who spends so much energy in bringing about an increase in wages that he has little life and pride in the prosecution of his work.

There is wealth which is not measured in gold, and yet is wealth worth the having. At the end of life some men have plenty of money and no culture of mind and heart; and some have culture and no money. But there is substantial wealth in both. They should supplement each other. It is pitiable to have culture and lack the means to gratify it; and it is lamentable to have money and so lack in culture that you do not know what to do with it and hold it like a miser or spend it like a fool. It is infinitely better to so manage matters that you are likely to have wealth of both kinds.

You will not understand me as expressing indifference to the accumulation of property. Quite the contrary is true. One who cares not for this, who fails to do what he can to provide for his needs when his earning power shall be gone, lacks in that ordinary foresight so common in the race that the absence of it classes one with the defectives. What I am saying is that the way to secure that provision is to assume the risks which may be balanced by your personal endowments, and that the way to be sure of being competent to enjoy the accumulations of a lifetime is to keep the joints lubricated with the oil of fellow-feeling. Start out with more energy than conservatism so that your whole life taken together will be an even one, for the time will come when you will have more of conservatism than of energy. Let old men talk about an abundance of caution; you think of what will result from an abundance of action. Keep the dollar in your minds, but put as much thought upon enriching your minds and your souls, upon living creditably and stimulating the common energy of the people among whom you live, as upon accumulating in your pockets. Put your energies into earning rather than into hoarding; and, as you earn, spend your money in ways that will keep the juices in your body and put serenity and grace enough into your later years to make them worth the living.

Let the will balance the emotions. If we throttle the feelings we are little more than mechanism refined; if we allow them to run loose we defeat our own desires and make of ourselves a laughing-stock. We are to nourish and restrain them. He who lacks integrity of feeling lacks rightness and effectiveness of action. It is spirit that lifts the individual and drives the world; but it is spirit that is enriched by intelligence and controlled by the will which makes headway and gains respect.

Bear disappointment with composure, and affliction with fortitude. The noise one makes does not measure the sorrow he suffers. Let the hatreds be governed by a short statute of limitations. After a hard blow straighten up as soon as possible and readjust yourselves to the new conditions as quickly as you can. Carry your steadiness with you and do not leave your civility and courtesy at home when you move among people and enter the activities of the world.

Think now and then of the point of equipoise between personal independence and good citizenship. "Independence" seems to be bred and born in us. The very word has a rythmic, musical sound to the American ear. Independence and self-dependence are taught from the kindergarten to the university. Because our citizenship is free and the suffrage universal we hear talk about every man being an "uncrowned king." Political parties seek support on the declaration that they care nothing for the view of any other nation. Yet we are each but a single fiber of a single strand, of a single thread, of a broad fabric which has been centuries in the weaving and which has been slowly put together under the rules of economic law. Remember how much all the people and all the things about you mean to you. Recall the family circle, the neighborhood set, the social structure, the church organization, the fraternal order, the city, state, and national institutions, and see how helpless you would be if they were taken out of your life. After all, success is measured by the number of the friendships, the depth of the sympathies, and the extent of the training we get through our contact with the people and the institutions about us.

We are not, and in the nature of things we cannot be, a law unto ourselves. There are obligations between friends, acquaintances, citizens, which are personal and mutual. We are all subject to the common customs, traditions and understandings of the race. One who does not know this and act upon it is a social and a public burden. The organizations, establishments and institutions of the civil state spring from the people. The people never ordained them to give us a living, but to afford the opportunities and facilities for self-culture, and to give us security in the right to work peacefully and enjoy the fruits of our labor without interference. He who tries to change the natural order of things and get his living out of the common organizations and institutions which the people have established for their common good, he who withholds from them the full measure of his enthusiastic support, becomes a pitiable dependent, a poor, if not a bad citizen, and indeed a discredited man.

Think of the details. Every man who builds a house, paves a street, lays a sewer, mows a lawn, starts a factory, stands up for a better school, supports a church, cheers for a party, fights for the integrity of the suffrage, and sustains the civil power, contributes to the common good, and more surely than in any other way to his own permanent advancement. The man who neglects to do these things when he can and ought, shrinks into insignificance. Selfishness defeats itself. Have an individuality of your own, and as you pass out of the College commence a work and a manner of life which in time will put the world under obligations to you. Do not spend too much time seeking devices to save labor; do not lay plans to get something for nothing; do not deceive yourselves into thinking that there may be a road to prosperity and eminence which is not paved with anxiety and filled with intelligent and honest toil; do not sponge on fraternal orders; do not think you are better than other people when you are only narrow; never advertise your business on the fair face of your flag.

Most of you have determined the kind of employment to which you propose to devote your lives. But many of whom this is true will change their plans in order to accomplish their purposes. Some of you will find in time that you have made a mistake in the kind of work you have taken up. Such need not feel chagrined. They may find satisfaction in the fact that the number of persons who have changed from one vocation to another, and then made conspicuous success, is exceedingly large. You are entitled to find pleasure and reward in your work and to carry on the work in which you can find the most satisfaction, and you are entitled to have a reasonable time and sufficient trial to make certain of what that work is.

It would be a great help to you if you could fully realize how much one's intellectual development depends upon his mental food. The lines are now being set, upon which your entire lives will be projected. It is even noticeable in your student days. The hard students show it in their faces; so the social butterflies show that in their faces as well as in their term reports; the scientists put on glasses early. All this and much more is only the outward proof of the changes which are going on in the mind. Then be sure that the mind is rightly nourished and that the lines are rightly set. No matter what work you take up for gain, do not fail to continue your studies and enlarge your libraries after you leave College. Gratify your natural love for sport. Let your better natures grow; do not be afraid to freely express your moral sensibilities, for they will not gain strength without exercise and expression, and their full development is imperative to a useful and successful life. Keep balanced; see and investigate things along the road; yet keep in touch with life. Read the newspapers and mingle constantly in affairs; yet do not become so engrossed in material things that you neglect to cultivate the culture side; and if you have not already begun this course begin it now.

It is a satisfaction to think we see that each great cycle of the world's life leads the race up to a higher plane. Nature is continually advancing and ascending. As with the physical world, so it is with normal life. So let it be with you as the years turn off the periods of your lives. It is said that the solar system, perhaps the whole stellar system, is in motion towards one point,—the great center of gravity of the infinite universe. Is it not likewise true that the infinite universe of life is moving along God's greatest and most wondrous cycle to the point of everlasting rest? How do we know, indeed why should we not think, that the experiences through which the great human family passes are but the beatings of the truth upon the universe of thought and the breakings of the bonds which finally shall set the whole race free?

We know, indeed, too well, that the journey of a student's life leads away from our doors. We must say the last public farewell. May your characters round out and come into perfect equipoise. May your stores increase. May you be steady when the strain comes. May your influence widen and strengthen. May each succeeding cycle of your lives advance you to a higher plane. May you take on the multiplying years gracefully. And may the end be perfect peace.

THE WOMAN'S CLUB MOVEMENT A SIGN OF THE TIMES.

TERESA A. BRISTOL, REPRESENTING THE WOMEN'S COURSE.

In all the annals of history there has never been a revolution more complete, more far-reaching in its results, none whose true causes are less understood than the revolution through which the social world has just passed, and by means of which the emancipation of woman has been accomplished. The extent and significance of the movement has never been completely realized, except by the very few, but it has nevertheless been a topic of absorbing interest to the public mind for the last ten years, and there have been many reasons assigned for the existing state of affairs. Although no one of them offers a complete explanation, probably all of them have been factors in the development of the present condition of woman. It is argued by some that the whole social organism is a direct outcome of the increasing spirit of democracy—that, in the effort to bring everything to a common level, man has unconsciously received woman on the same footing with himself. Others contend that woman has recently discovered her actual superiority over man in many respects, has found out that she possesses undreamed of abilities, and has risen above the conventions that have, until recently, bound her down to a narrow walk in life. It would seem more logical, however, to ascribe female liberty to the fact that woman has simply responded to her opportunities. The last half century has teemed with events of vital importance, especially to the American people. The practical extermination of one race of people and the emancipation of another, the growth of our large cities, the development of the public school system, the rise of democratic ideas, the progress in science, resulting in wonderful inventions—all these things have had a most important influence upon the civic and social existence of this people. What wonder is it that woman, when she saw growth and development about her in every direction, responded to the quickening touch, and found herself able and eager to accomplish what she would never have dreamed of attempting fifty years ago? What wonder that her horizon has broadened, until now, forgetting her own limitations, she is in danger of rushing to the opposite extreme?

The Woman's Club movement is the natural and logical outcome of the position the sex has taken for itself. Mankind has always realized that "in unity there is strength," hence whenever there has been a definite end to accomplish he has formed associations. The vast army of Crusaders was nothing more nor less than a society with the red cross for its badge and the capture of the holy city for its object. A more striking example of this tendency is found in the labor guilds, which sprang up all over Europe during the Middle Ages, and did nore than anything else to weaken the power of feudalism. The condition of France just prior to the French Revolution furnished another opportunity for men to unite in the accomplishment of a great purpose. In the same way woman has realized that her position is a critical one, and that order can be brought out of what now appears like chaos only by united action on her part. This I believe to be the true explanation of the origin of the Woman's Club movement. Its growth has been enormous and rapid, and a study of the present condition of affairs shows that in many ways it is the most complete expression that we have of the spirit of the times.

In the first place, the question arises, "Is the Woman's Club a fad?" It is a difficult one to answer. When we consider how recent the movement is, and the enormous proportions to which it has already attained, we are astounded. Over one million American women are enrolled as club members. More than this, during the last seven years such perfection of organization has been reached that individual clubs are now joined together in one grand federation, and below this are the State federations, which are of no mean importance. Then the multiplicity of objects for which clubs have been founded is truly wonderful. We have the purely literary club, the club with political aims, the university extension club, the club founded for social purposes only, the club which meets once a week to discuss Bach's fugues, and the Luncheon Club, whose members combine the pleasures of the palate with the flow of soul. Many women are active members of half a dozen clubs and pay dues to as many more. In view of these facts we are tempted to answer the question in the affirmative, and pronounce the Woman's Club one of the typical fads of the day. But although the movement is subject to this criticism it has, nevertheless, an underlying strength and dignity of purpose which lifts it far above the level of golf and pink teas. The superficial woman and the faddist come into intimate touch with women of strong intellect and noble purpose, and the influence of the latter is certain, in the end, to raise the standard of the club.

Again, the prevailing spirit of democracy is regarded by many as one of the most significant development of the present day. Its spread has not been so rapid among women, because the feminine mind is by nature aristocratic, but it is rapidly gaining ground even here, and the club is a most important factor in its development. Mrs. Van Riper finds, for example, that plain Mrs. Brown, whom she has been accustomed to regard as far beneath her in the social scale, is preferred before her on account of superior intellectual, executive, or artistic ability. She finds that hers is not an exceptional case, that the same thing occurs wherever the club has been founded upon the sound basis of recognition of individual merit, regardless of persons. As a consequence Mrs. Van Riper's aristocratic ideas receive a rude shock. The democratic feeling is promoted much faster, however, by unity, or at least sympathy of purpose. There is nothing more leveling than this. In earnest striving for a common end the time honored traditions of caste are forgotten, and even women become, for the time purely democratic.

While this spread of democratic ideas is a source of congratulation, there is another tendency of this age which is not. I refer to the disposition among both men and women to acquire a wide surface culture, rather than to become really well-informed along a narrower line. The so-called educated person of today must possess a bundle of information pertaining to almost every conceivable subject upon which the thinkers of the world have thought or written, from the weaknesses of Plato's philosophy to the hidden significance of the last movement of the Czar. This tendency is naturally manifested in its most pronounced form in the club, which is often founded purely for intellectual or educational purposes. Some one has said that "clubs and classes are for the accumulation of superficial information, and for unloading it on others, without much individual absorption by anybody." While this is far from being strictly true, there is nevertheless a deplorable leaning toward extension rather than intension, toward breadth rather than depth. Although this has the advantage of awakening the mind to a sense of intellectual duty, and produces brilliant versatile minds, it is also true that the reason for the present dearth of really great writers can be traced largely to this same tendency.

Another significant feature, which relates purely to the social life of the times, is the fact that the feminine sex has recently discovered that it can enjoy itself independently, and as a result there is a growing disposition toward a separation of social interests. Dinners, receptions, functions of every sort, exclusively for women, are becoming common everywhere. From the very nature of the club itself they are more frequent in connection with club work than anywhere else. It is a serious question whether or not this growth of a separate social life for women may not have a markedly deteriorating effect upon the aesthetic and moral status of man. Whether this be true or not, the fact remains that there is a decided separation.

Another phase of club life is its connection with reforms. This naturally comes about, because reform is the cry of the age. Political reform, municipal reform, social reform, these are only a few of the needs of the hour which have been taken up in earnest by the women of today. Much has been accomplished by clubs which have definite aims in this direction, particularly in the matter of city health and cleanliness.

Hand in hand with this comes the discovery of administrative ability, and the thirst for political power, an interesting phase of woman's growth. The club furnishes an outlet in this direction. There is an opportunity for every sort of political maneuver. For instance, in the great convention of the national and State federations delegates may be influenced, remarks and motions previously arranged; in fact, all the machinery of politics is possible here, so that woman, although she may not have the ballot, has nevertheless an opportunity of proving her political ability.

But an infinitely more important and significant feature of woman's development is the spirit of desperate earnestness which characterizes all she thinks, says, or does. It would seem that, in the struggle for freedom, she has lost sight of the fact that it is not absolutely necessary to be doing something all the time, that there should be an occasional opportunity for complete rest. She has been called the unquiet sex, and with good reason, for although she has gained the high place for which she has striven, she is by no means content to stop here, but must go on and on with feverish energy, in the effort to accomplish something—she scarcely knows what. For this reason we do not expect to find her club what it should be—a haven where she may secure a complete rest of mind and body, but here, as everywhere else, she is dissatisfied unless she is enlarging her horizon in some direction. The club to her represents only another opportunity for exercising the nervous energy of which she seems to have such an abundant supply. The thinking person may well pause and wonder whither we are tending. If woman's emancipation means increased burden it is only natural to question whether or not her emancipation is an unmixed blessing.

It does not seem unreasonable to suppose that the Woman's Club will remain, as it is now, an exponent of the condition of the times. It will change and grow with the development and growth around it, and of which it is, in some senses, the center. We may hope that it will before many years reflect the fact that women have awakened to the necessity for a more composed view of their duties to society. Although it must always be earnest, grave, strenuous in spirit, it may also be a potent factor in teaching the overtaxed woman of today that, although she owes a duty to society, and the opportunities of the age in which she lives, she nevertheless owes a higher duty to herself—the sacred duty of rest.

SCIENCE AND AGRICULTURE.

S. L. INGERSON, REPRESENTING THE AGRICULTURAL COURSE.

The greatest earthly possession of the human race is the fertility of the soil. It is the source of food supply. Between this store-house of nourishment and the consumer stands agriculture, which thus holds a preëminent position among the occupations of men. No other vocation deserves more attention or calls for more accurate and scientific knowledge in its pursuit. At the same time there is no other branch of industry with regard to which less is known by the greater portion of those engaged in it. The world has not yet outgrown the ancient fallacy that anybody can farm. This, like many other great errors, contains not a little truth; for men with almost no knowledge of the subject and no inclination to study it have become farmers, and some of them have even amassed fortunes at the business. Yet in nearly all cases their success has been achieved at the expense of the soil fertility, and those who follow them upon the same land with the same methods must meet with disappointment and failure.

In most all countries lands which have been under cultivation for a long term of years have steadily decreased in productive power. The onward march of civilization has been the onward march of devastation. In the lands formerly occupied by the empires of Assyria, Media and Phoenicia, the seats of the greatest civilization of their day, fields which once smiled with abundant harvests are now only wastes of burning sand. The valley of the Nile has been saved from a similar fate only by the annual overflow of the river. The once fertile lands of Europe are being exhausted. Slowly but surely the tide of destruction and waste has moved westward with civilization. It has crossed the Atlantic, has seared the hills of New England, and is sweeping across the great plain. The fair valleys of the Mohawk and the Genesee already shows its blighting influence. A comparison of present conditions with those of forty years ago reveals great changes in the farming lands of our own State. The large crops which were raised by the early settlers are not duplicated today. We are wasting our soil capital and are drifting toward the bankruptcy of soil-exhaustion. Any other result has been brought about by one of two causes. Either the requirements of the farming class have been limited to the bare necessities of existence, while by a strict system of economy handed down from father to son nothing has been taken from the soil without a corresponding return being made, or the business of farming has been made the subject of careful study, and its operations carried on according to scientific principles. In either case the fertility of the soil has been preserved by the addition of fertilizing materials. The former system is exemplified in China and Japan The latter is practiced in some small portions of Europe and America, and is the only system which is practical in this country·

The problem of soil-exhaustion is further complicated by the fact that greater demands are made upon the soil every year. The increase of population in this country is resulting in the division of land into smaller and smaller parcels, each of which must support a family. Moreover, the farmer of today requires more in the way of luxuries than did the farmer of a century ago. And these must be paid for by the products of the soil. Aside from matters of production, other serious questions are demanding the farmer's attention. The foes to agriculture in the way of insects, weeds, and plant and animal diseases are constantly increasing and are a serious menace to agriculture.

The term agriculture, as used today, includes not only the process of tilling the soil, but also the body of scientific truths underlying the operations of cultivation. The art of agriculture or farming is as old as civilization; the science is of recent origin. The science of agriculture is based on several other sciences. First among these may be mentioned chemistry and the closely related subject of soil physics. These sciences deal with the nature of soils, the composition of plants and their relative feeding value at various stages of growth, essential and non-essential elements of plants, and their source, the composition of fertilizers and the best form in which to apply them. The discovery of Liebig that by the action of sulphuric acid insoluble bone phosphate could be rendered soluble and thus immediately active has been of immense value to agriculture. No less important a science is botany, which aims to discover the laws of plant growth that lie at the foundation of successful crop production. By its aid plants of economic value are discovered, studied, improved, and each planted in a location best suited to it. Botany has produced new races of wheat and other grains, has given us our seedless fruits, and has revealed the nature and effect of fungous diseases. Liebig thus summed up the interdependence of botany and agricultural chemistry: The scientific basis of agriculture, embraces a knowledge of all the conditions of vegetable life, of the origin of the elements of plants, and of the source from which they derive their nourishment." These two sciences form the basis of agricultural science and have stood shoulder to shoulder in its development.

The science of bacteriology, too, though comparatively new, has come rapidly to the front. It has revealed the cause of some of the worst diseases of plants and animals, and in many cases has been able to find means of treating them. The discovery of serum, used in the treatment of bacterial diseases, is one of the triumphs of modern science. To the dairyman bacteriology has given the pure culture starter, which is as essential to his highest success as a good yeast cake is in bread making. One of the problems of the bacteriologist today is to produce bacteria which will form root tubercles for the storing of nitrogen on our grain plants in the same way as they are now formed on the roots of clover. And there are good grounds for hope that this may be accomplished. Veterinary science, also, has contributed no small amount to agriculture. This science has done away with a great many false notions in regard to diseases of animals and their treatment, and has shown the utter uselessness of many of the painful operations to which the surgeon formerly resorted. It has stimulated the farmer to more careful feeding and greater cleanliness in the handling of his stock and thus has helped in the prevention of contagious diseases. The immense amount of damage done by insects makes the study of these foes an essential branch of agricultural science. Only the entomologist is able to say how each one may be best held in check. Many of our worst insects come from across the ocean. Nature's check has been destroyed; for they are taken away from their natural enemies, and are thus enabled to multiply rapidly.

One of the most effectual means of combating these foreigners is the introduction of insects which prey upon them. A notable example comes from California. The cottony-cushion scale introduced from Australia was at one time the most serious insect enemy of the Golden State. An Australian lady-bug which feeds upon the scale was introduced into California, and in a short time had so nearly exterminated the pest that specimens were difficult to obtain. Another branch of science which should not be passed by is meteorology. In experiment station work it is often of as much importance to know the conditions of weather as the kinds of soil. This can be determined only by careful meteorological observations. "To be forewarned is to be forearmed," and it is often of great benefit to the farmer to know what changes in the weather are likely to occur in the immediate future. Many of the predictions of storms and frosts the farmer can make for himself with tolerable accuracy by the aid of a few simple and inexpensive instruments and the tables which a scientific study of meteorology has furnished.

These, then, are the sciences which, working hand in hand, have contributed most to the advancement of agriculture, to its elevation from the position of a mere process for wresting the means of subsistence from the soil to the dignity of a science. The science of agriculture aims to answer the practical questions which arise in connection with farm operations, to place agriculture on a rational scientific basis. It aims to tell not only how but why a certain course is pursued. Science does not confine itself to the solution of problems which already confront the farmer, but attempts to anticipate his needs. It endeavors not only to save him from being mastered by the forces with which he has to deal, but to enable him to rise above them, and to become himself master of the situation. It brings to his notice new and promising plants and renders valuable aid in the development of new industries. The beet-sugar business now being developed in this country is a good example.

There are two principal ways in which science reaches the farmer—through the agricultural college and through the experiment station. Both of these agencies are doing a great deal for agriculture. Each has its own line of work, yet each is in some measure indebted to the other. The college gives scientific training and teaches established truths. It is the source to which the experiment station must look for its workers. The experiment station is at once the discoverer and the disseminator of new truths.

We have thus seen how science is an advantage to agriculture. But it is more than an advantage. The growing demands made on the soil simultaneously with the decrease in productive power, together with the spread of weeds, of injurious insects, and of diseases of animals and plants, have so increased the difficulties of production as to make science a necessity to the highest success in agriculture. He who would drive his business instead of being driven by it must understand that business. The farmer is no exception to this rule. He must be alert and ready to grasp any new idea which will help him in his work. This does not mean that he should be ready to accept every new theory which is advanced. Caution is needed in farming as much as in any other line of business. "Prove all things; hold fast that which is good," in agriculture as in religion. But when a new principle has been thoroughly tested and its merits established it is only wisdom to accept it. He who clings to the old merely because it is familiar invites failure, and must sooner or later be left behind by his more judicious neighbors. And it is a hopeful sign that farmers are coming more and more to recognize the need of studying their business, of bringing the energies of mind as well as of body to bear upon their work.

The scientist and the farmer are coming more closely in touch every year. The scientist finds in the solution of the practical problems of agriculture as broad and as fascinating fields for study as can be found anywhere. And the ancient prejudice of the farmer against "book farming" is slowly but surely disappearing. Agricultural science is as yet in its infancy. What has already been done along this line is but the foreshadowing of a new day when agriculture, divested of its load of ignorance and superstition and resting on accurate, scientific knowledge, shall take its right and proper place among both the sciences and the professions.

MICHIGAN LIVE STOCK IN 1899.

SHEEP.

C. P. REYNOLDS.

Sheep husbandry in Michigan for the year of 1899 will compare favorably with the results of other years. Reports from various portions of the State indicate that the wool clip has been usually large and the quality generally good. The lambing season has been attended with good results, and a large number of home-grown lambs will be conditioned for the markets during this, and the forepart of the coming year. Flock masters are fast recruiting their flocks with desirable sheep, and indications are very favorable generally.

Sheep raising is occupying the attention of a large portion of the farmers of the State. Some who have not handled sheep in several years are laying a foundation for a flock; others who have held to their flock through depressions are making preparations for an increase in numbers. The value of grade breeding ewes depends entirely on age and general quality, but as a rule prices will range between three dollars and five dollars per head. Grade sheep of good quality outside of these limits are an exception and not the general rule. Pure bred, but unregistered, sheep will range in value about the same.

The popularity of the better bred sheep is constantly increasing. Farmers are more thoroughly appreciating the fact that better breeding pays; in conformity with this more well bred, including both pure bred and registered, rams will be used among the average farm flocks during the breeding season of 1899 than during any recent years.

It would be impossible to give an accurate estimate of the ruling breed, though in all probability the demands for a sheep that would be fair at both wool and mutton has led to a very liberal crossing with the English breeds. Consequently, without any attempt to argue the superiority of one or the inferiority of the other, it is safe to assert that among average farmers, who are making no attempt to breed anything but grade flocks for wool and mutton purposes, the rams with English tracings predominate. Reports are to the effect that coarse wool sheep breeders have no trouble to dispose of all surplus stock at fair prices; while in some cases fine wool breeders can not supply demands.

This seems to be a good indication, and it is undoubtedly a fact, that the demand for fine wools is improving. This seems to be borne out by the fact that the fine wools have ranged close to the top generally in the Eastern market, if not topping it entirely. This is something that has not occurred before to any such extent in years, and must mean that the wool sheep is coming once more into popular favor. Good authorities have given it as the opinion that there will be more fine wool rams used among the flocks of Michigan during the mating season of 1899 than has been the case in several years. This is due in all probability to the constantly growing scarcity of the fine wool sheep heretofore, and the consequent decrease in the supply of fine wool on the markets. Should these surmises prove to be a fact it will undoubtedly mean that there is in store a period of prosperity for the fine wool grower of the State, and that the year 1899 will mark the beginning of better times for the fine wools.

The wool market for the year 1899 has not been as generally satisfactory as many would have desired. Apparently prices have not ruled as high as a year ago. Last year many farmers who received twenty cents per pound for unwashed wool have been compelled to take eighteen cents this season for practically the same grade and quality. Approximately prices for other grades have ruled accordingly. The causes assigned are various, and the unsettled state of public opinion is too marked to ascribe definite causes. Among reasons that are generally given, each having a more or less weight, perhaps, are the following: Sheep husbandry not sufficiently recovered from recent business depression; unsatisfactory wool legislation in national politics; too much wool rushed into the country under Wilson law before the Dingley act went into effect; combinations of money power exerting an influence, and over production.

Competent authorities urge that Michigan sheep growers are making a serious mistake this year, as they have formerly, in not giving more attention to selection of breeding stock. Too many breed indiscriminately, and do not give proper attention to retaining rams of the same general type and breeding; many change the breeding of their flock by an occasional introduction of rams of different breeds. The result is little uniformity in texture of wool, even from the same flock. Also, localities err in not breeding a uniform quality and type. The direct result is mixed grades and lower prices.

This year has seen less sheep washing than formerly. Slowly but surely the custom of washing sheep before shearing is passing into disrepute among farmers generally. This seems to be pronounced among the class who are interested in grading their flocks by introducing pure bred rams, particularly.

Sheep feeding, and particularly fatting western-bred lambs, has not been so successful generally this year as in seasons past. Two reasons can be assigned for this. In the first place, they cost too much after being delivered here, so that in many cases, and especially where they were sold before the middle of March, the margin between the buying and selling prices was too slight for great profit, and in some cases actual losses. Again, grain has been constantly coming up in value, so that the feeder was compelled to feed a ration that was constantly increasing in worth to stock that was practically at a stand-still. In fact, it looked for a time as though the feeder would be obliged to sell at but a slight increase of the purchasing price, which in many instances would have been at a serious loss.

Fortunately for many there was a decided improvement in the market about the middle of March, which enabled those who were able to profitably hold their stock until that time to come out at least clear, and in the majority of cases at an actual profit. Before the change in market values came it was reported that many who had invested heavily depending on good markets would lose very considerably, and in all probability even as circumstances were many did not realize a fair margin on the investment.

It is an open question if lamb feeding paid the farmers of the State in the aggregate last season. Those who fed home-grown lambs in all probability came out more than whole; but it is safe to venture that those who went out of the State for their feeders did not realize the profit that they did in former years. Taken as a whole, for the average feeder the season of 1899 will not compare favorably with better years that have passed.

The following is a list of the markets for sheep for the first six months of 1899. In the estimation of the writer better than nine-tenths of the sale made during the first half of the year will come within the limits given below:

Markets for January.

Good to choice lambs, 80 to 100 pounds	$4 75 to $5 00
Light to good and bucky, 60 to 80 pounds	4 25 to 4 75
Yearlings and good mixed lots	3 80 to 4 75
Common to butchers	2 00 to 3 75
Culls to fair wethers	3 25 to 3 75

Markets for February:

Good to choice lambs, 80 to 110 pounds	$4 70 to $4 85
Light to good and bucky, 60 to 80 pounds	4 00 to 4 65
Yearlings and good mixed lots	3 75 to 4 25
Culls to fair wethers	3 00 to 3 75

Markets for March:

Good to choice lambs	$4 70 to $5 35
Light to good and bucky	4 00 to 5 25
Yearlings and good mixed lots	3 75 to 4 85
Culls to fair wethers	3 00 to 4 25
Clipped lambs	3 75 to 4 25

Markets for April:

Good to choice lambs	$5 50 to $6 10
Light to good and bucky	5 00 to 5 70
Yearlings and good mixed lots	4 40 to 5 00
Culls to fair wethers	3 30 to 4 50
Clipped lambs	4 40 to 5 00
Spring lambs	6 50 to 8 00

Markets for May:

Good to choice, clipped lambs	$5 00 to $6 25
Light, good and bucky	4 65 to 5 85
Culls to fair wethers	3 00 to 4 85
Spring lambs	6 25 to 8 00

Markets for June:

Good to choice lambs, 45 to 65 pounds	$5 00 to $7 50
Yearlings and clipped lambs	4 35 to 5 50
Fair to mixed butchers	3 35 to 4 50
Culls and common	2 00 to 3 50

In looking into the situation of sheep in the markets of the State, the writer has relied largely on the opinions of hucksters and butchers, and especially those who represent the great bulk of buyers. Their general opinion seems to be so far as the consumer is concerned, that mutton is higher this year than either last year or the year before. The same that is selling for fourteen cents per pound this season sold for twelve and a half last season and for ten cents the year before.

Butchers report that they are receiving a better quality of fatted sheep this year than in recent years, due largely, as they assert, to the introduction of pure bred rams of suitable breeding into the common flocks. Fat stock are fairly plentiful though there is a tendency that the supply will shorten before the advent of another year.

Lambs are mostly in demand. Some assert that they sell, as a rule, at least four lambs to every sheep out of the small city markets. The weights preferred are from forty to fifty pounds. Heavy lambs are not wanted at first class prices on the local markets. They only sell to good advantage when shipped to principal markets.

It seems to be a general opinion among butchers that the demand for lambs and yearlings in preference to older sheep is going to have a tendency to take desirable breeders out of the flock, and consequently decrease the general breeding value of the flocks. If this surmise proves to be a fact, it will be very harmful to the sheep interests of the State.

As suggested above, one of the causes of low prices last winter for lambs, or rather the loss of profit realized by the feeder below or over the cost, was due to too much being paid by the feeder for Western lambs. Drovers and hucksters also include the fact that too many lambs were unloaded onto the market about the holidays, with the effect of making the supply greater than the demand. The overloaded market did not recover until into March, when it improved, and the seeming scarcity caused the markets to go still higher.

As a rule butchers and hucksters do not regard the sheep and lamb market of the immediate future to be as stable as the same in other lines of fat market stock raising. Or, in other words, so far as market values are concerned, buying and feeding lambs will be undertaken with more or less risk to the feeder.

The heavy hog has been forced out of the market, and in the same way the heavy sheep bids fair to be obliged to follow suit. The heavy sheep is no longer wanted on the local markets throughout the State on the same basis as the medium heft and lighter breeds. The medium weight sheep is the one invariably preferred. In the larger markets there is still and doubtless will be a comparatively limited demand for the heavy weights.

A representative huckster recently stated to the writer that the type of sheep of which the Leicester is one is about the thing demanded by the markets of the State, and especially those that supply a local demand. He regarded the Lincoln type too large for the markets of the present and future. He also said that the Shropshire was a good sheep from his point of view, if not allowed to become too fat before marketing. It was his expressed opinion that the fine wool type should confine itself entirely to wool production.

SHEEP BREEDING IN MICHIGAN.

A. A. WOOD.

The sheep industry of Michigan has been and is one of the most important branches of agriculture, and anything pertaining to it in a general way should be of interest to the average farmer. It is, therefore, very fitting that a few words as to its condition at the present time should be embodied in the annual report of the State Board of Agriculture. We shall not burden the reader with statistics or details, but shall confine ourselves to a few general conditions and tendencies which are important and worthy of consideration by one in any way connected with the sheep industry in this State.

The sheep of the average farmer in Michigan today are for the most part of Merino stock, that is, the breeding ewes are high grade Merinos improved more or less by the use of pure bred Merino rams on the native stock. This use of Merino rams was made in past years in order to increase the weight of fleece, and thus increase the farmer's income. Some attention was paid to the size and form of the carcass, but it was a secondary consideration. In the course of time this condition was changed, due to two causes, viz.: the low price of wool, and the development of a good demand for high-class mutton. These two conditions led the Michigan farmer, who quickly adapts himself to changed conditions, to use rams of the mutton breeds, in order to continue to make his sheep a source of income to him.

Nearly all of the various mutton breeds have been more or less used, but the Shropshire seems to have proved the best fitted to cross on grade ewes, in order to produce mutton lambs which secure the highest price and the quickest sale. This has led in many cases to the destruction of the Merino flocks, and where they have been replaced it has been by the cross-bred ewe lambs saved from the market and used as breeders. This, however, is confined to those parts of the State which are near a large market and where the cross has been used for several years.

The use of mutton rams has necessarily led to a change in the quality and quantity of the wool produced by the Michigan farmer, the medium wool of the cross-breds displacing the fine Merino wool, at the expense of nearly half the weight of fleece. Since the increased demand for fine wool during the last year or more, together with a comparatively higher price than the medium wool, has become a fact, there have been many of the progressive farmers who have sought a mutton Merino ram which has also a good fleece of fine, thick wool. One of the characteristic features of the present time is this tendency of the general farmer to come back to the Merino type, not the greasy, wrinkly type of twenty-five years ago, but the plain mutton Merino which produces a fine fleece of good weight with a shapely and good sized carcass. This type of rams has been much used during the last year, and promises to continue and increase in popular favor so long as wool is a good price and fine wool is in demand. This demand for mutton Merinos has been filled, according to the idea of the individual purchaser, by the Rambouillet, the Delaine, and the large, plain American Merino. Just at present there seems to be, on the whole, the largest demand for the Rambouillet, although both the other breeds mentioned follow closely, and most of the breeders of these classes of rams have had a good business during the last year, with the most flattering prospects for the coming season.

So much for the general farmer and his active interest in sheep breeding in Michigan at present. We now wish to turn your attention to the condition of the breeders of pure bred sheep in Michigan. Time was when the old Spanish Merino, which has evolved into the present American Merino, far outnumbered all other breeds, and its breeders formed one of the strongest and largest State live-stock associations in the country. But with the changing demand of the farmers, who are the breeders' customers, the field of the American Merino has been invaded by the other breeds, and many former Merino breeders have now changed to some other breed, or have quit the business entirely. However, the excellence of the American Merino has been maintained and improved by a large number of breeders in the State, who have been a great factor in maintaining Michigan's reputation as a leading sheep State. Some of these breeders have aimed to breed for the ram market of the great west, and have therefore bred a large, smooth sheep with blocky shape and thick, long fleece. Others have bred for the foreign markets of South Africa and Australia, and in order to meet this demand have produced a wrinkly, dense-fleeced sheep, giving particular attention to quality and density of fleece, but also taking care to have a strong constitution and a good sized carcass. Still others have bred both types, and all have succeeded to a greater or less extent.

A few years since, a few farmers who desired to breed a mutton sheep with a fine Merino fleece introduced the Delaine sheep into Michigan. They have increased gradually in numbers, and at the present time have a good demand for all their surplus stock at good prices, both among the farmers of Michigan and in the west. Another type of Merinos is the Rambouillet, for which Michigan is the headquarters in this country. This is a very large sheep with good mutton shape, and a rapid grower. They also carry a fair fleece of fine wool, which is nearly as heavy as the Delaine fleece, but of a somewhat different character. They, too, have been bred toward a combined wool and mutton ideal, but, if anything, rather more attention has been given to the mutton quality than the wool.

Coming to the English mutton breeds, we find the Shropshire in the lead, followed closely by the Lincoln. The Shropshires, which are a middle wool sheep, have found great favor with Michigan farmers to use in breeding mutton lambs, and to meet this demand there have naturally been many farmers who have given their attention to breeding for it. Until within about a year there probably have been more Shropshire rams used on the flock of the average farmer in Michigan than those of any other one breed; but the price and demand for fine wool having increased, the general farmer has sought after a mutton Merino, and has consequently somewhat curtailed the market of the Shropshire breeder. A few years since, Shropshire breeders enjoyed a large western trade in rams, but for the last year or so it has been more limited, although still fair for good rams. The mainstay of the Shropshire market in Michigan, however, is its own farmers who are breeding feeding lambs.

Another English breed which is pressing the Shropshire in the race for popularity is the long-wooled Lincoln. There are a large number of breeders of this popular sheep in Michigan, and they appear to be increasing. As yet their best trade has been the west, which has taken a large share of their rams for range breeding, and it bids fair to take all the surplus stock this season. The average Michigan farmer has not yet used the Lincoln very much, but will no doubt do so as time goes on. Of the other mutton breeds, the Southdown and the Hampshire have several breeders and many friends in this State, as have also the Oxford and the Cotswold. All of these latter breeds, however, have hardly proved as popular with the general farmer as has the Shropshire, although they all have their good qualities and their particular friends.

In considering sheep-breeding in Michigan, a word concerning the associations of the breeders, the men who promote the interests of this great industry, is necessary. In the absence of definite statistical information, we are inclined to believe that Michigan has a greater number of sheep-breeders' associations than any other state. We need only to mention the Michigan Merino Sheep Breeders' Association, the National Shropshire Sheep Breeders' Association, the National Black Top Sheep Breeders' Association, the National Lincoln Sheep Breeders' Association, the Michigan Oxford Sheep Breeders' Association, and many others, of which many or all of the officers and members reside in Michigan. The members of these associations are among the brainiest and most progressive farmers in the State, and the work they have done in forwarding the interests of Michigan as a sheep-breeding State and a great agricultural State in general is as great as that of any other single class of farmers.

In closing this brief survey of the condition of the sheep industry in Michigan, we can truly say that it is flourishing, with prospects of the continuance of such conditions for years to come. The fine wool breeders are prosperous with their market in the west and in foreign countries, and also the prospects of a fair share of patronage among Michigan farmers. The breeders of middle and long-wool sheep are also in a flourishing condition with their large home market, aided more or less by the range trade of the west. Taken all in all, the business is a profitable one, with plenty of room for more good reliable breeders who do not expect to see the wool or mutton turn into gold, but are satisfied financially with a good profit on the investment, and otherwise by the fact that they are working in one of the highest branches of specialized farming.

THE WOOL INDUSTRY OF THE STATE OF MICHIGAN FROM THE PRODUCERS' STANDPOINT.

PROF. H. W. MUMFORD.

Unfortunately this is a subject which interests sheep men only. We venture, however, to discuss the subject because we believe there are enough sheep owners to warrant our careful consideration. Naturally we think it is unfortunate for the farmer who is not a sheep owner and incidentally a wool grower. I trust that this discussion will serve a two-fold object:

First. To call more special attention of sheep owners to the importance of the wool product of their flocks and thus induce them to adopt methods better calculated to improve both the quantity and the quality of their wool.

Second. That this may be a true statement of the condition of the wool industry of Michigan in the year 1899. In order to understand the present condition of the wool industry in Michigan it will be necessary to review somewhat briefly the methods which have been pursued by sheep men in general for the last ten years or more.

For several years back the sheep raisers have paid little or no attention to the product of their flocks. The very fact that wool has been so low in price has led many a sheep owner to lose his interest in the wool industry, and when, added to this, we have observed the relatively high price for mutton, we do not wonder that the wool industry has received so little consideration. The wonder is that any one should continue to breed sheep for the primary object of producing wool. So far as we know, there is not a country in the world which has ever been noted for its wool product that has not suffered more or less from the effects of low wool and high mutton.

However, a very potent factor has been that, notwithstanding the loss of interest in the wool product by a large majority of men, there has been a few who were giving attention to this subject and still continued to breed mutton sheep, arguing, and with some degree of correctness, that they could produce as much value in fleece from the purely bred mutton sheep as a Merino breeder could produce from his Merino flocks.

We say with some degree of correctness during the first few years of the introduction of English mutton sheep in America and other countries, a very large proportion of the sheep throughout the country were high grade Merinos, and consequently there was a large percentage of fine wool to be sold on the market and relatively a very small percentage of medium and coarse wools. Naturally enough there was a good demand for medium and coarse grades of wool and a special call for fine wool, which would tend to decrease the breeding of Merino sheep and the increasing of breeding the mutton types. And this, looking at the subject from the standpoint of the production of wool only. We see, then, how the flocks of our State and other states have gradually, though surely, changed from high grade Merinos to high grades of the different varieties of English mutton sheep.

Fashion, too, which has always played such an important part in the wool industry, has, from time to time, caused a variation in the price of the different grades of wool when there has been no other apparent reason for the high and low price of certain grades of wool.

Now that there promises to be better prices paid for the different grades of fine wool, we observe quite a general sentiment among sheep men to return to the use of Merino rams on the grade flocks of the country. If they are not already doing this, they are planning to do so in the near future.

The wool grower is not unlike other men in that he is anxious to get the best possible returns from the money he has invested in his flocks. If he imagines that he can increase the value of the wool product by a change in the breeding methods, or even of breeds, he will do it, and no amount of philosophy will stop him.

We have spoken briefly of the circumstances which have led up to the present condition of our Michigan flocks and incidentally of the wool product. Let us now consider a little more in detail just what this condition is. I presume if we were to start out today and canvass carefully the wool buyers of Michigan we would find that not one-third of the wool which they handle would grade in any of the fine wool classes. The remainder would grade either as medium or coarse. Formerly there was a considerable difference in the price of the fine and medium wools, and this difference was noticeably in favor of the medium grades. At present we find the sentiment of the market changing. We have an abundance of medium and coarse wools and a great scarcity of fine wools. Those who understand clearly the difference in Merino and coarse wools in their natural state will understand that in buying a pound of Merino wool we are really buying less of wool and more of something else than when a pound of medium wool is purchased; so that if we should buy the wool at the same price in the grease, the medium wool would be worth more per pound after being scoured, which, as a rule, is true.

While the past and the present of the wool industry is all very interesting and important, yet we are all deeply interested in the future. The question naturally arises, with the conditions stated above, what is the best way out of the difficulty and how can we best manage our flocks to secure the greatest possible net profit. Most men who are Merino enthusiasts will say unreservedly to get out of mutton sheep as soon as possible and breed nothing but Merinos. While this would seem good advice at first thought, we may wonder what the result would be if such a general course were adopted. It is not hard to see that it would be disastrous in the end.

While we believe the time has come when sheep owners can very profitably devote more careful thought and attention to the wool product of their sheep, yet we fear that the tendency will be to cause a wholesale slaughter among our fine mutton flocks, which can only result in a great financial loss to the sheep men of this country.

There will always be a good demand for prime mutton, and we believe that a man who has a nice flock of mutton sheep, which produces from seven to ten pounds of wool per head, would better think seriously before converting his flock into fine wool producing flocks. We are confident that the Merino breeders will see an era of prosperity, yet we think that the breeders of mutton sheep ought to be willing to leave the field for them to conquer, permitting, if you will, the new accessions to sheep husbandry to become breeders of grade Merino sheep.

Without making any radical changes in breeding or breeds, there is much that might be done to improve the value of our Michigan wool product. Our Michigan wools can be better grown and better prepared for the market. At present the man who is careless in feeding and who takes no pains to keep dirt and foreign substances out of the wools which he sells receives about as much per pound for his wool as the man who spares no pains or expense in putting his wool on the market in the best possible condition. The farmer who sells wool to the local dealer is in about the same position, or is placed at about the same disadvantage, that the farmer's wife is who has no other market for her butter than the country grocery—not that we have any criticism to offer either on the country grocery or the local wool dealer. The grocerman is forced to pay about so much per pound whether it is butter or soap grease. Those who have had experience know how hard it is to convince Mrs. A. that her butter is not just as good as Mrs. B.'s. The wool dealer finds himself in precisely the same position. He must pay all farmers producing a certain grade of wool about the same price, no matter what the condition of the wool. This makes it necessary for the careful, painstaking man to sell his wool for less than it is worth, while the careless man gets more for his wool than it is worth. This leaves but two avenues for escape for the progressive wool grower. He must either ship his wool direct to the commission houses of woolen factories, something not altogether a desirable practice, or demand that the local dealer pay him an extra price for his trouble. Ordinarily selling to the local dealer is most satisfactory, if only a small clip is to be marketed. It could hardly be expected that he could make all the wool producers prepare their wool for the market in a careful manner, and thus relieve the wool dealer of all suspicion that the wool is in a bad condition.

The change in the wool industry in Michigan from producing a large percentage of fine wools to that of coarse wools has, along with other conditions, brought about changes in the methods of handling the wool product. For example, take the question of washing sheep, which used to be a universal practice, has now fallen into quite general disrepute; partly from the lack of encouragement offered by the wool dealers and manufacturers, because experience proved to them that farmers were not properly washing their sheep, and partly due to the fact that a large number of the farmers are shearing their sheep early in the spring, before it is possible to wash them.

It is a noticeable fact that Michigan wools are sold in the eastern markets at about two cents less per pound than the same grade of wool from Ohio and Pennsylvania. It would be well for our Michigan growers to study carefully into the reasons for such discriminations against our Michigan products, and if possible aid in bringing about a change for the better.

Perhaps it would be well to suggest what we consider some of the reasons for this condition of affairs. First, we believe that Ohio and Pennsylvania have been less affected by the mutton craze than Michigan and some of our western states. Localities in Ohio and Pennsylvania may be found where there is a large amount of one grade of wool produced. In Michigan such a thing is almost impossible. In one township may be found nearly all of the grades of wool quoted in the market. This makes it impossible for a buyer to come into a certain section and buy only the grade of wool he wants without getting some wools which he does not care to handle. While Michigan has a very large number of flocks of registered sheep, she has also a very large number of grade flocks, and the bulk of the wool produced must, in consequence, come from these grade and coarse bred flocks.

Scouring mills that handle wool on commission are not anxious to secure our Michigan clips because they are of such varied character, preferring to purchase of the western ranchmen, where large lots of wool of the same grade may be purchased of one individual.

Commission men tell us, we hardly know whether to believe it or not, that Michigan wool growers are more careless about preparing their wool for the market than are Ohio and Pennsylvania sheep men. They tell us that the Michigan wools are more apt to be chaffy and poorly tied. We do believe that we could reform materially by using a twine manufactured from flax and by using less of it.

As a final word, we would suggest that those who have built up at a considerable expense flocks of mutton sheep of high quality should be very slow in disposing of them at a sacrifice and building up Merino flocks at long prices. But those who have flocks of little or no breeding or quality, or those who have no flocks at all, will do well to plan to produce a fine grade of wool. All should be more particular in the growth of the fiber, that a stronger fiber and a longer staple may be produced. Keep your sheep away from straw stacks and other places where they are likely to get their wool full of litter or burrs. Tie your fleeces with as little wool as possible and let the twine be small and of the right material. If you attempt to wash your sheep, let the work be thoroughly done and shear your sheep as soon as the fleeces are thoroughly dried.

For further information in regard to the subject of wool, we beg to call your attention to a bulletin which we expect will soon be issued from the Michigan Experiment Station.

MERINOS IN MICHIGAN FOR 1899.

SECRETARY E. N. BALL.

It is a matter or general information that the sheep business of our country is experiencing a very active and remunerative epoch. Within two or three years prices on all breeds and classes of sheep have improved; during the same time wool has made a material advance in value, and especially Merino or fine wool.

In comparing sheep and wool statistics of three and four years ago with the present year, everything tends toward improvement in prices. Mutton is holding its own, but is not so closely confined to the strictly mutton breeds as during a few years past. The heavy weight lamb or wether on the market commands no higher—scarcely as high—a price as the medium weight animal, whether it be strictly of the mutton type or a cross with one of the different types of Merinos.

From the wool growers' standpoint there is an outlook of encouragement. It is interesting to note that during the fiscal year just ended the importation of raw wool into the United States was only $8,322,897 worth, as against $16,783,692 of last year, and $53,243,191 in 1897, a falling off between the years '98 and '99 of over 50 per cent, and over 150 per cent between '97 and '99. This change benefits the Michigan wool grower along with those of other states, and many a farmer who disposed of his sheep in dull times has to pay an advanced price to replace them, or be without the best paying adjunct to successful farming today.

At a recent meeting of the New Jersey State Board of Agriculture the farmers were strongly urged to turn their attention more to the sheep industry. Confining ourselves a little more closely to Michigan, for the Merino breeder there is encouragement. Merinos in Michigan today are of several types. The older, the American Merino, descended from the Spanish importations, heavy shearers, with short to medium length staple and more or less folds; later, the Delaine, with the fine long staple and smooth bodies, and still later, the French, with short to medium wool and large plain bodies. These all are experiencing better times, the Delaine and French to a marked degree.

Reports show the sales of these breeds to have been more numerous and at better prices than the registered American Merino.

Among the breeders of Merinos there have been some disappointments in the advance so long looked for, coming so slowly; and as yet good prices are few and far between. However, we look forward to better prices and quicker sales. If the price of wool holds good, the sheep that produce it will be in demand.

To say that there is a boom in Merinos in Michigan up to date, August, '99, is not to be contemplated, yet everything looks as if a decided improvement would be experienced ere long by breeders generally, as it has been by some already. The breeder of the American Merino may rest assured of one fact: when Merino wool brings from 17 to 20 cents per pound, the Michigan farmer wants the sheep that will produce and that class of sheep that will produce the most of it, and the American Merino of the past and present will be the one sought after in the future. No one can tell with certainty what the future will bring forth; but the

Merino in Michigan for 1899 is all right. The business is remunerative, probably paying as well as any other branch of mixed husbandry.

We note that the sales of car lots for the west are Merinos or Merino grades, and very few others are sought after. There was a time lately passed when car lots of Merinos were not wanted, were not salable, but today it is very different; we know of several lots being sold of late at prices that are profitable to the breeder, but they consisted of large, plain sheep, Merinos of one of the three breeds mentioned above, and the breed has less to do with the sale than the size and smoothness of the individual animal. There is an improvement in the sale of sheep for export. While there are a few bought, the quality has to be extra good, and the Merino of ten and twelve years ago fills the bill today.

Many have quit breeding the registered American Merino during the past ten years, but the older pioneers in the business are still holding on, and after a number of years of depression the future looks better—the present is better.

Just as long as clothing is worn, just so long will Merino wool be used, and that from Michigan is just as good as there is in the world, and the Michigan breeder will raise it just as long as there is profit in its production.

OXFORD DOWN SHEEP IN MICHIGAN, 1899.

H. J. DeGARMO.

In preparing this, a record or history for Oxford Downs of Michigan in 1899, for your honorable board, it seems almost necessary to go back to an earlier date for the start. And, in the short time alloted me, together with other work on hand, I may not gather as accurate or complete a record as your honorable body, or even your humble servant, might wish.

The history of Oxfords in the United States is, comparatively, of recent date, to say nothing of their history in Michigan. The first Oxford imported from England to the United States was during, and for the purpose of show at, the Centennial held in Philadelphia in 1876, where he was awarded sweepstakes over all mutton breeds in America. This ram, Freeland No. 220, with others, was purchased by Americans, and from this time dates the importation and breeding of Oxfords in America. The honors won by Freeland No. 220 in 1876 were again won by an Oxford ram, Heythrop Prince 2d, No. 7920, at the World's Fair at Chicago in 1893. And again at Omaha in 1898 by an Oxford ram, Dick Stowes, grand champion ram of the show. Thus the Oxfords have carried off the honors at the three greatest shows the world has ever known.

The history of Oxfords in Michigan is still of a more recent date than that of him in the United States, the exact date of which, with regret, I am not able to give. But records show that a Mr. J. H. Peabody of Birmingham, Oakland county, purchased nine imported ewes and an imported ram from one Mr. Wm. M. Miller of Claremont, Ont., about 1882 or 1883. These were probably the first Oxfords owned in the State of Michigan. It is stated by good authority that for this flock Mr. Miller refused upwards of $600 offered by a Wisconsin man. For some reasons, unknown, Mr. Peabody did not continue as a breeder very long, and this flock soon went through purchase of one C. A. Learing, Lyon, into Ionia county. This was about 1886, and he again sold them in 1892 to your humble servant, H. J. DeGarmo, Highland, Michigan, in whose hands the descendants still remain. Up to 1887 there were less than half a dozen flocks of pure bred Oxfords in Michigan. About that year Mr. L. N. Olmsted, Muir, started through purchase of Mr. Powise, Wayne, Ill., what is now conceded the largest and oldest flock of registered Oxfords in the State.

From 1886 the Oxford flocks in Michigan increased slowly until the panic of 1893, when they came to a standstill, or nearly so. But for some reason the flocks did not decrease, as was the case with most other breeds. I know not the cause unless it was that the owners believed they had a good thing and would stick to it, knowing that the Oxford would take care of itself, his owner and his farm at whatever stand government finances or tariff might take. It is a curious fact, conceded by nearly if not all, that the Oxford not only of Michigan but of the United States was the last breed of sheep affected by said panic or hard times of 1893 to 1896. Our prices for rams did not fall materially during that time. The Oxford breeders stuck to and improved their flocks, getting ready for the reaction which, they believed if they did not almost know, must come. It came! and along with it a cry for Oxfords. That cry is still heard, but there are not Oxfords enough to supply the demand.

The Oxfords in Michigan are comparatively a poor man's sheep. That is, there were no millionaires back of them to boom them. And this is the case today, not only in Michigan, but of the breed, also, in the United States. They have had to stand and live upon their merits. No one has had any spare money to spend upon them. Consequently, they have not been shoved to the front at once, as some of the other breeds, but have gradually walked to the front rank without the aid of superfluous money to advertise them.

From 1882, the start of Oxford breeding in Michigan, until 1896, we had a growth of scarcely a breeder per year. But, in the late summer of 1896, there were eight or ten of Flint's business men, composed of doctors, merchants, manufacturers and bankers, who had farms in the near vicinity of that beautiful little city which they wished to stock with pure bred stock of some kind. For some reason they concluded to buy the same kind of stock. They further concluded that sheep were what they wanted, and as the fair season was at hand a committee attended the industrial show at Toronto and other Canadian shows. This was in September, 1896. They looked the sheep thoroughly. There was a fair representation in all of the mutton classes; the Shropshires, Hampshires and all of the Down breeds were well represented. But the Oxford was the better class of them all, in the eye of these Michigan gentlemen, at the Toronto industrial.

Within a month there were imported from Canada by these gentlemen some 150 head of beautiful Oxford Down sheep. These sheep were the foundation of eleven good flocks in the near vicinity of Flint. Having launched out in the breeding of pure breed sheep, it seemed natural as well as necessary for them to, and they did, form what is known as the Genesee County Oxford Down Sheep Breeders' Association. This association has a membership of about twelve members, each of which owns a good flock of pure bred Oxfords.

In October, 1896, I received a letter from one Mr. E. O. Wood of Flint, asking my opinion (presumably from the fact that I was the only Oxford breeder in Michigan then carrying an Advertisement) as to the advisability of calling the breeders of the State together in the near future for the purpose of forming a State Oxford Down Sheep Breeders' Association. I thought it advisable to have such an organization for the benefit of the Oxfords of the State of Michigan. But as we had a good American Oxford Down Record Association, used both by Americans and Canadians for preserving records, that it was not advisable to form a new and separate record association. Furthermore, that the older breeders of the State would not concur in any such action. The result was that early in January, 1897, all known Oxford breeders of the State were asked to meet at Flint, February 2, 1897, for the purpose of organizing a State Association of breeders of pure-bred registered Oxford Down sheep. The following named gentlemen and breeders of Michigan were present: J. W. Murphy, Cass City; L. N. Olmsted, Muir; W. D. McNeal, Grand Blanc; W. J. Webber, Reese; H. J. DeGarmo, Highland; H. R. Perry, Ellington; L. J. Wilson, Nashville; R. L. Foary, Nottawa; J. W. Neal, Quanicassee City; J. A. Thomas, Wisner; A. A. Thomas, Burton; Eugene Wilham, Burton, and W. A. Atwood, R. J. Whaley, W. A. Patterson, H. C. Spencer, E. O. Wood, E. S. Lee, W. F. Stewart, Alex. McFarlain and Dr. B. F. Miller, of Flint, who, after driving about and visiting the several flocks owned by the members of the Genesee county association, met at the office of Dr. B. F. Miller at 7:30 p. m. and proceeded to form a State association.

Preliminary organization was effected by electing H. J. DeGarmo of Highland, chairman, and Dr. B. F. Miller of Flint, secretary.

Remarks were made regarding the benefits to be derived from such an organization by Messrs. Miller, Wood, Murphy, Frary, Olmsted and Webber, after which we proceeded to form the Michigan State Oxford Down Sheep Breeders' Association.

This association has the usual quota of officers and board of directors. Each applicant must be a member of the American Oxford Down Record Association and the owner of at least ten recorded Oxford sheep to become a member of the State association.

The following were the officers elected, who served two successive terms:

President, H. J. DeGarmo, Highland; vice president, W. J. Murphy, Cass City; Secretary-treasurer, Dr. B. F. Miller, Flint. Board of directors, L. N. Olmsted, Muir; W. J. Webber, Reese; Ed. S. Lee, Flint; N. D. McNeal, Grand Blanc, and R. L. Frary, Nottawa.

This association has been and will continue to be of great benefit to the Oxford breeders of Michigan. Each breeder in the State should become a member for his own as well as the benefit of other breeders, and the breed which he heralds. It has a plan whereby each and every member is notified as to what the other members have for sale, thereby making it easy to direct buyers who wish a carload, or wish something you have not, thus benefiting each other as well as the intended purchaser.

In June, 1899, we had for sale in this State upwards of 270 pure-bred Oxfords, 150 of which were rams and ram lambs.

Through the Michigan State Oxford Down Breeders' Association and the Genesee County Oxford Breeders' Association, the annual meetings of the American Record Association, with its little handful of members in attendance at each meeting, was carried out of the state of Ohio into Michigan with a meeting of 30 members, besides as many visitors, at the meeting held in the library rooms of the Patterson block in Flint City. There was a great hue and cry by breeders of other states against taking the meetings out of the state of Ohio, it being most central to the Oxford districts of America. But Michigan gave them a good meeting, and, against the prophecy of breeders from other states, did not retain the annual meetings in the State, but without having a Canadian member present, voted to hold the next meeting at Brantford, Ont., during their fat stock show. This meeting was held December 2, 1898, with about 40 breeders in attendance, and Michigan was favored with the election of Vice President H. J. DeGarmo and Director Dr. B. F. Miller, Flint.

Michigan has at the present time (August 10, 1899) thirty-two, or about one-fifth of the stockholders in the American association. Ohio comes next with twenty-eight members. The whole of the Canadian dominion exceeds Michigan by only four members in the American association. It is a curious fact that nearly all of the stockholders in the A. O. D. R. A., and all of the Michigan members, are actually engaged in breeding Oxfords. These flocks in Michigan will number from 20 to 175 head of pure-bred Oxfords per flock. It is estimated that there are about 2,500 pure-bred Oxfords in Michigan in August, 1899. It is found upon inquiry that these flocks vary somewhat in the weight of fleece, probably due as much as anything to the difference in feed. The lowest average for a pure-bred flock that I have found is eight and one-half pounds per head, and that at less than eleven months' growth. The Hickory flock of Oxfords has an average for young and old for five consecutive years of a little over eleven and one-half pounds per head. There are a few flocks that are up to between fourteen and fifteen pounds per head.

The Oxford differs from the Shropshire and Hampshire in being a little heavier carcass (the heaviest of the Down breeds), and much heavier fleeced. The wool is generally longer than the other breeds mentioned, is strong and has a good luster, sells very readily for combing wool. His head is somewhat longer but not as wide as either the Shropshire of Hampshire. In color his face should be lighter than either of the others. It should be an even, dark gray or light brown. The scale of points will probably give all further description needed.

Scale of points for Oxford Down sheep in four divisions:

Breed type	30
Constitution	25
Mutton form and quality	30
Wool	15
Total	100

SUBDIVISIONS

BREED TYPE OF ANIMALS.

Form or a good general appearance made by the well balanced conformation, free from coarseness in any part, and showing good style, both at rest and in motion	15

Head of moderate length and width between the ears and between eyes, and well covered with wool poll and down to eyes, color of face an even dark gray or brown, either with or without gray spot on tip of nose	6
When fully matured and in good condition, rams should weigh from 250 to 350 lbs., ewes 180 to 250 lbs.	5
Ears medium size, not too thick, and of an even brown or dark gray color	2
Legs short, strong in bone, flat and of even dark gray or brown color, placed squarely under the body and well apart	2

CONSTITUTION.

Large around the heart and wide and full in the chest	10
The movement must be bold and vigorous	5
Eyes bold, prominent and bright	4
Skin bright pink in color	3
Neck strong and muscular in rams and well set on in both sexes	3

MUTTON FORM AND QUALITY.

Wide and straight on top of shoulders, back, loin and rump from base of neck to tail	15
Full shoulders and thighs, well meated inside and outside	5
Flanks well filled and strong, so as to make the lower lines of the body as straight as possible, and side lines straight or rather full	4
The whole carcass evenly covered with good, well marbled meat	6

WOOL.

Fleece of moderate length, close and of even quality, covering the whole carcass well, and free from black patches upon the body, neck or head	15

This scale of points is a little different from that used by other breeds, inasmuch as it is subdivided. It was adopted by the American Oxford Down Record Association at their annual meeting in 1896.

The Oxford, generally speaking, is a very aristocratic or proud spirited sheep, carrying its head well up and walking off with a firm and quick step. And in this State, as well as upon the range, is giving good satisfaction in crossing with other breeds, as he not only gives more size, but increases the weight of fleece almost twice that of the other Down crosses.

We have some as fine flocks of Oxfords in Michigan as can be found elsewhere in America. He has found friends as well as a home in Michigan, and has come to stay, as he will surely live and prosper here.

RAMBOUILLET MERINOS IN MICHIGAN, 1899.

THOMAS WYCKOFF.

Origin of Rambouillet a La France. On October 12, 1786, Louis XVI, King of France, placed on the domain of Rambouillet three hundred eighteen ewes and forty rams selected by the most expert judges from the lion races in Spain, permission to do this being granted by the King and Queen of Spain. They were animals of unusual vigor, size, form and of the choicest wool. This experimental farm was established to send out anima's to improve all the wools of France. An ideal race of sheep were to be produced, such as the world had never seen. The keenest expert directors were selected to accomplish this task. In 1870 M. Bernardin, the greatest director ever at Rambouillet, said to me: "The fold at Rambouillet can show by record and statistics that the managers have produced a race of sheep which they sought to produce from the start. That other Merinos are not of the same value or title as those of the fold at Rambouillet, either as to the production or as to the qualities of wool and meat."

CHARACTERISTICS AS TO WOOL.

These sheep have the finest wool in the world where bred pure. The crimp is perfect from beginning to end of wick, showing no variations, and the undulations are perfect and different from any other wools of such greater length, retaining the crimp with tenacity after being subjected to elasticity that would destroy it in any other wools. The length, strength and elasticity of this wool have no equal among the fine wools of the world. It is free from excessive grease, and the fleeces are not only very dense, but of immense bulk, weighing in ram's fleeces 18 to 30 pounds, and in ewe fleeces from 12 to 22 pounds, scouring 50 per cent in average wools.

CHARACTERISTICS, AS TO FORM, CONSTITUTION, ETC.

They are noted for great vigor, endurance, rapid growth, nutritive capability, precocity, broad chest, round barrel, long bodies, straight legs, large bone, stout neck, with one or more folds, bright eyes, quick movement, unusual fertility and are iron clad as to all ordinary catarrhal disorders. Rams attain to 200 or 300 pounds, ewes 125 to 200 pounds at maturity. A Rambouillet sheep can always be known by his royal bearing, stately carriage, rythmical movements, symmetrical action and perfect development. A judge of sheep can tell at a glance that they are thoroughbred in the highest degree, and, I may safely add, the sheep are not contented unless in care of intelligent men. They always manifest thankfulness for favors shown with usual intelligence in such animals.

IT IS NOT WITHOUT FORCE THAT RAMBOUILLET FRANCE AND RAMBOUILLET U. S. A.

lead the world today with the best sheep in existence. Much of the great advance and wonderful achievement of the fold in France is owing to Emperor Napoleon's personal interest in, and love for, his noble race of animals, which he loved to visit, watching their improvement, care and development.

OTHER MICHIGAN FLOCKS OF FRENCH MERINO SHEEP.

In 1868 Captain Henery Grinnell, of Michigan, purchased a flock of Mr. Cooley in Oakland county. Mr. Cooley's flock proceeded from a purchase from Amasa Stanton, of New York, who brought his flock to Michigan in 1860, stating that he purchased them as Rambouillet sheep from the importation of Hon. J. D. Patterson.

Mr. Grinnell has used imported rams from Canada and Europe. In 1870 he purchased two rams from the experimental farm at Guelph. He has used only pure Van Homeyer rams since 1890.

In the past fourteen years have sprung up from the Grinnell flock the flocks of L. D. Townsend, C. L. Halladay, Bingham, Davis Bros., Peabody, Higby, Keyser, Sly, Moad, Marsh, Ruess, Davis, Coleman, Scilly, Fletcher Bros., Chubb Bros., Phelps, and a score of others. Thousands of sheep in all, and nearly all these men are using pure Van Homeyer rams in their flocks, and have done so from the beginning with Grinnell ewes.

It is probable that had a record been started earlier for this valuable breed of sheep, many other flocks of Michigan would have been of undoubted purity, but as all breeders have for ten years used rams only of unquestionable value and purity, the breed has attained great popularity, and come into deserved favor wherever found, as they are as large as the English breed for carriage only, and have the best wools in existence, while their longevity is double that of any other breed.

RAMBOUILLET U. S. A., ORCHARD LAKE, MICHIGAN,

was founded by importations from the flock of Baron F. Von Homeyer of Prussia. The flock of Van Homeyer originated from Rambouillet, France, in 1850. He had several thousand of these sheep of the finest specimens in all Europe in 1885, and astonished the world by the magnitude of the animals he exhibited at the world's fair at that time in Europe, also in the U. S. A. Columbian Exposition in 1893. The finest importation from his flock to Michigan was made by Wyckoff in 1889. In 1891 the proprietor of Rambouillet visited the flocks of Europe, taking a thorough inspection of all the principal flocks of France and Germany, making a large importation from the flock of Van Homeyer and some from Roger in France. In 1893 an importation was made from the flock of the great director, Victor Gilbert Gilvert, in France. In 1894 an importation was made from the Van Homeyer flock of rams only. No importation has since been made since to Michigan, owing to government restrictions abroad in the U. S. A.

The flock now numbers as high as 900 on the register, sheep being shipped every month of the year to all parts of the Union, and to some foreign countries.

In 1898 Mr. R. M. Wood, of Saline, Mich., purchased a small flock of pure Van Homeyer sheep from the Markham importation of New York. In 1899 he purchased a large number more from the same source, and now has one of the choicest flocks in the U. S. A.

F. E. Eager, of Howell, has a flock of pure Van Homeyer sheep founded in 1890. He is a careful and expert breeder, having rams in his flock weighing 300 pounds.

The impressive power of these sheep is to be observed for ten generations on crosses made on any other breed, so strong are all their characteristics. Their great value and increasing demand are so well known on the western ranges of the United States as to need no other recommend.

MICHIGAN FLOCKS.

The highest standard flocks of Michigan today trace the origin of their sheep in unbroken lines and undoubted purity and accuracy to

RAMBOUILLET FRANCE.

The first importation of these sheep made to the United States was by our minister to France, Robert R. Livingston, in 1802, and placed on his farm at Clermont on the Hudson in New York.

Mr. Taintnor of Connecticut and New York made an importation in 1854, and did more subsequently to advance this race of sheep than all the previous importers.

Hon. W. G. Markham, of New York, imported a few in 1886, has made several importations since, and has a flock now that has no superior in the United States.

At the fold of Rambouillet U. S. A., at Orchard Lake, Mich., founded by Baron F. Van Homeyer, the two lines of Rambouillet flock have been united, namely, Van Homeyer of Prussia and Victor Gilbert of France, producing the largest, hardiest, best formed and wooled sheep in the world. As both originated at the government fold at France, it unites the old lines of blood that have been kept separate for more than thirty years, producing a phenomenal race as to size, form and constitution, and wool of the highest quality possible to be produced, animals of perfect covering, and wool from the nose to the hoof.

It looks as if the Rambouillet sheep, during the next quarter of a century, would become a great factor in the wealth producing animals of Michigan, sales of those sheep now annually reaching hundreds of thousands of dollars, going to every state and territory in the Union, and if not already done, will, in a few years, place Michigan at the head of the wool producing states.

MICHIGAN'S LINCOLNS IN 1899.

H. A. DANIELLS.

The breeders of Lincolns in this State having had a very successful year in 1898, increased their flocks and took increased care of breeding stock and their lambs.

A statement of the status of the different flocks will perhaps interest the public. J. J. England has a flock of 75, bred in part from his importation of 1894; they, like their owner, are large and broad and good feeders.

Post & Bigford have about the same number, bred from Canadian stock in part and in part from English stock. They are good feeders, and their sheep are both large and broad.

A. H. Warren has some well bred and well fed Lincolns.

Price & Dexter, of Saginaw county, and their neighbor, Edw. Parsons, have a fine bunch that makes them proud of being the pioneer breeders in that county. Eaton county has such noted breeders as Bert Smith, O. D. Hitchcock, F. L. King, Jas. Mott and Frank Spicer. Being directly connected by the C. & G. T. with Chicago, the western ranchmen cleaned up all their yearling rams early in the season. They have some choice bred animals.

Wm. Shier and Robt. Knight & Son represent two of the earliest breeders of Sanilac county, and have two of the largest flocks in the State. Wm. Shier's flock is headed by the English bred Royal Winner, Royal Chester, bred by Henry Dudding, of Lincolnshire, and obtained by Mr. Shier at a long price. R. Knight & Son are using a ram of Robt. Wright's stock of Nocton Heath, England.

Josiah Tompkins & Son and H. A. Daniells represent the southern part of Tuscola county in Lincolns. Mr. Tompkins' flock of ewes was obtained from England, Daniels', Shier's and Knight's flocks, and are headed by Royal Defiance, a heavy shearing ram from Royal Chester 1514. H. A. Daniells' flock is made up from his different purchases in Canada and from ewes descended directly from Dudding and Wright herds in England. This flock is headed by Oakdene, a son of the noted Lord Stanley 565, bred by Dudding.

E. O. Wood & E. P. Oliver represent Genesee county, and have some choice ones. Barton Duke, that heads the Oliver flock, was bred by Dudding, and is a large upstanding ram. Mr. Wood purchased the first prize winning yearling at Omaha and some good ewes in Canada.

George D. Moore, of Lenawee county, is the only breeder there of a stud flock of Lincolns; that he has some good ones goes without saying to those who know Geo. D.

H. P. Gage and Geo. W. Swagart are making things lively in the western part of Clinton county with their choice flocks, while H. E. Hudson, A. D. Bradshaw and W. Dunkle are breeding some of the best.

M. L. Wasson and W. W. Crittenden are breeding and selling Lincolns lively over in Livingston county, and are good men to call on.

Jas. H. Shafor, of Ingham county, is quietly building up a flock, while Henry Dale, the boy breeder of Shiawassee county, will be heard of later. A lad who has the nerve to buy Lincolns at the price he paid, and join the Association and attend the annual meetings deserves all the good luck we wish him.

We have overlooked one of our best and oldest flocks in Tuscola county, owned by Dr. H. A. Bishop, who has bred from such rams as Jumbo, St. Jo, Newport King, imported from England, and Riby 2d. His 1,400 pounds of wool topped the market.

Eph Knight, in the northern part of Tuscola county, is building up a very fine flock.

John Lencht, of Westphalia, one of the few Germans we know who believe in registered stock, has a fine flock, and is a large hearted, fine man to call on.

E. Osterhout and Geo. P. Casler are two of the younger breeders at Ovid, and started with good stock and are trying hard to surpass their teachers.

J. B. Hoffman, over in Saginaw county, is building up a choice flock on the rich grasses Saginaw county is noted for.

Hon. S. L. Bignall, of Fowlerville, began his experiment with Lincolns by crossing a Lincoln ram on his fine flock of Merinos (which, by the way, makes one of the finest mutton and wool animals on earth.) He was so well pleased with the cross that in '97 he purchased a fine bunch of registered animals and is an enthusiastic breeder of the best.

Lewis Epkey has a boss flock, whose foundation was purchased of Post & Bigford.

F. R. Crawford, Laingsburg, we are told, is building a premier flock and reputation.

Lewis Bros., of Perrington, are up-to-date breeders.

G. J. Welch and D. B. Sanders represent Calhoun county in the lordly long wools, and are making fortunes breeding and selling the same.

James Mott, the genial director of this Association, has a flock made up mostly of descendants of English bred stock, and are a worthy flock and shepherd to visit.

This Association, the pioneer Lincoln registry association in the world, was started in 1891 with nine members, in Lansing, Mich., and has grown to 133 of the best breeders of Lincolns in North America. We have registered nearly 6,000 sheep, have shipped thousands to the western ranges, where their popularity is excelled by no breed. The lordly Lincoln has come to stay.

SWINE IN MICHIGAN IN 1899.

SECRETARY GEORGE H. McINTYRE.

A. C. Bird, Secretary State Board of Agriculture:

You ask me, what are the conditions surrounding the breeders and feeders of swine in Michigan? Michigan is not generally classed among the hog states. Hog feeding has with us always been more an adjunct to our diversified system of farming than a specialty. The man with a hundred hogs is the exception rather than the rule; still, it would be an exception to find a farm without a few hogs. The average per farm for the State I should think not far from 25.

We have all the breeds represented, but have never been afflicted with the craze for certain fancy strains, nor have our breeders of pure bred stock been led into the risk of investing in stock at the boom prices that have affected other states. That we have as good blood and as good herds as are to be found, cannot be denied, and it only is necessary that our breeders arouse themselves and meet breeders from other states in the show ring and sale pavilion to demonstrate that Michigan is not behind in the race for supremacy.

The Michigan State Swine Breeders' Association, organized eleven years ago, is doing much to bring about the desired result. It has been the means of bringing breeders together for the exchange of ideas of mutual interest, of awakening a desire to improve the conditions surrounding the industry, and to foster a resolve to place ourselves in the front rank, where we feel that we belong. At our last meeting the question of public sales was generally discussed, and we believe that ere long we shall find our breeders disposing of their surplus stock in this manner. Another benefit of our Association meetings has been the score card practice, or, perhaps, it were better to call it a school of instruction. In the hands of the expert judge the score card may not be of much use, but to the novice we believe it to be of great benefit as an educator.

Until the last few years we have escaped cholera and plague in our herds; but '98 saw quite an extensive loss from these diseases (s). Baffling the best efforts of veterinary skill and improved sanitary measures, it run its course, in some instances destroying herds of pure bred stock that had taken years of patient toil and liberal outlay of money to establish, and in others, taking the only pig from the poor man's pen. But at this date, August 20, no outbreak of the disease has occurred, and we are hoping for the best later on. Great interest is felt in experiments now being conducted, and we believe the time not far distant when the loss from this source will be reduced to a minimum.

We are just emerging from an era of depression and low prices, and the man with hogs to sell at this date is in luck. The past few years of business and financial depression had its effect on us as well as on other industries, but the five cent hog is here and our star is in the ascendancy. There is a peculiarity about swine breeding that differs from breeding cattle, sheep or other stock. The swine breeder never gives up. Let prices be high or prices be low, disease come, pigs die, or any of the many drawbacks to the business occur, he is always ready to try again. And, as a consequence, when things are favorable, he is cheerful, and when unfavorable, is never depressed.

Notwithstanding the light pig crop of last spring, the condition today is all that can be desired. With prices advancing and freedom from disease, the swine breeder has reason to feel gratified. With the improved economical condition of the country, we feel that the man who raises what the market requires and sells it in good condition has a bright future before him.

There has been more or less discussion in regard to raising the bacon hog, and so securing a better price for our product, but we think the careful, conservative man will hesitate before leaving a surety for an uncertainty.

Taken altogether, I think the condition surrounding us today all that can be asked for, and it is only necessary that we continue to improve our herds, watch the public demand, and furnish what is demanded, that we may receive the reward that ever follows perseverance.

MICHIGAN LIVE STOCK SANITARY COMMISSION.

J. H. BROWN.

The object of this Commission is to prevent and suppress contagious and infectious deseases among the live stock of the State. There are three commissioners, who are practical farmers and live stock breeders also a State Veterinarian.

The duties of the Commission are very little understood by many farmers, and we frequently meet owners of live stock who do not know that such a commission is in existence.

Every farmer who owns stock should familiarize himself with the "Live Stock Sanitary Laws" of the State, which are very stringent and efficacious in protecting the health of our live stock if properly enforced. Much of the resultant success of these laws depends, in a large measure, upon the energy and thoroughness with which local health officers carry out, in spirit as well as in letter, the various measures provided.

We wish to call especial attention to sections 4, 5, 6 and 7 of these laws, as follows:

Sec. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to establish, maintain and enforce such quarantine, sanitary and other regulations as it may deem necessary.

Sec. 5. It shall be the duty of any person who discovers, suspects, or has reason to believe that any domestic animal belonging to him or in his charge, or that may come under his observation, belonging to other parties, is affected with any disease, whether it be a contagious or infectious disease, to immediately report such fact, belief or suspicion to the Live Stock Sanitary Commission, or a member thereof, or to the local board of health or some member thereof.

Sec. 6. It is hereby made the duty of all local boards of health, to whom cases of contagious or infectious diseases are reported, to immediately investigate the same, either in person or by some member or members of the board, or by the employment of a competent and skilled veterinarian; and should such investigation show a reasonable probability that a domestic animal is affected with a contagious or infectious disease of a malignant character, the local board of health shall immediately establish such temporary quarantine as may be necessary to prevent the spread of the disease, and report all action taken to the commission or to some member thereof; and the acts of local boards of health establishing temporary quarantine shall have the same force and effect as though established by the commission itself, until such time as the commission may take charge of the case or cases, and relieve the local board of health. All expenses incurred by local boards of health in carrying out the provisions of this act shall be paid in like manner as are other expenses incurred by said boards in the discharge of other official duties.

Sec. 7. The commission or any member thereof, to whom the existence of any infectious or contagious disease of domestic animals is reported, shall forthwith proceed to the place where such domestic animal or animals are and examine the same, and if, in his or their opinion, any infectious or contagious disease does exist, he or they shall prescribe such temporary quarantine and regulations as will prevent the spread of the contagion or infection, and notify the State Veterinarian, who shall forthwith proceed to the place where said contagious or infectious disease is said to exist and examine said animal or animals, and report his or their finding to the said commission, who shall then prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease, and for that purpose the said commission may list and describe the domestic animals affected with such disease and those which have been exposed thereto and included within the infected district or premises, so defined and quarantined, with such reasonable certainty as would lead to their identification, and no domestic animal liable to become infected with the disease or capable of communicating the same, shall be permitted to enter or leave the district, premises, or grounds so quarantined, except by the authority of the commission. The said commission shall also, from time to time, give and enforce such directions, and prescribe such rules and regulations as to separating, mode of handling, treating, feeding and caring for such diseased and exposed animals as it shall deem necessary to prevent the two classes of animals from coming in contact with each other, and perfectly isolate them from all other domestic animals which have not been exposed thereto and which are susceptible of becoming infected with the disease, and the said commission and veterinarian are hereby authorized and empowered to enter upon any grounds or premises to carry out the provisions of this act. When, in the opinion of the commission, it shall be necessary to prevent the further spread of any contagious or infectious disease among the live stock of the State, to destroy animals affected with, or which have been exposed to, any such disease, it shall determine what animals shall be killed, and appraise the same, as hereinafter provided, and cause the same to be killed and the carcasses disposed of as, in their judgment, will best protect the health of domestic animals of the locality.

The commission has been able to practically suppress nearly all contagious and infectious diseases of live stock, with the exception of tuberculosis in cattle and swine plague.

Numerous cases of actinomycosis (lumpy jaw) have been reported during the last year, and each case quarantined. The treatment recommended in mild cases is almost invariably successful. Each quarantined animal is released as soon as pronounced cured by the State Veterinarian. Successful treatment of any contagious disease, or preventing the spread thereof, is assured only when a rigid quarantine is maintained, and local health officers should take all possible pains to assist owners of infected herds or individual animals to check the spread of any outbreak in its incipiency. Thoroughness in all details is absolutely essential to success in stamping out any disease.

The live stock of the State is in a healthy condition, with few exceptions. In previous reports from various sources, a certain per cent of some disease has been given as a fair average for the whole State, but there may be considerable inaccuracy in the per cent given, as the commission has never gathered any statistics of its own bearing upon the per cent of unhealthy animals in the State.

The commission does not believe in adopting such extreme measures as have previously prevailed with the commissions of New York and Massachusetts regarding the suppression of tuberculosis in cattle. Neither one of two extremes may be ultimately successful, and we doubt whether this disease among cattle will ever become entirely extinct, so long as "high pressure" environments are maintained by breeders of pure bred dairy cattle, and dairymen who keep large herds for a city milk supply.

A clearer knowledge of the laws of sanitation is imperatively needed by the majority of owners of live stock. It is true that pestilence follows ignorance, and one ignorant farmer in a neighborhood may, by carelessness, indolence and maintaining filthy environments, cause swine plague to spread among not only his own herd, but to a score or more of his neighbors' as well.

Swine plague and the so-called hog cholera are at hand, and our commission is making preparations to limit their ravages, so far as possible. We believe that special bulletins, prepared by this commission and sent to each township health officer where an outbreak of swine plague is reported, would be of great value in quickly and cheaply affording accurate information to every owner of an infected herd, showing him how to quarantine the diseased animals, treat the well ones, and urging improved sanitary surroundings and furnishing plenty of pure fresh water every day,

At this time of year many hogs suffer want of shade and pure fresh water, and we believe these conditions militate greatly against each animal's vitality, which is almost constantly lowered each additional day during the months of August and September. The lack of water and intense heat, combined with filthy surroundings, may not cause swine plague to start, but these conditions certainly do aggravate the disease in a majority of cases.

The losses from swine plague and hog cholera each season are greater than from all other diseases combined, often reaching several thousand dollars in a single township. As yet, no cure has been found for this disease, and prevention is far better than a cure. So, if the commission can, with the assistance of local health officers, and by means of special proclamation swine plague bulletins, reach the afflicted farmers in time to save a portion, if not all their swine, many thousand dollars' worth of swine may be saved that would otherwise be irretrievably lost to the farmers of Michigan.

The Seventh Biennial Report, also a copy of the Live Stock Sanitary Laws, will be mailed to any interested owner of live stock, upon application to the president or secretary. The commission consists of J. H. Brown, president, Battle Creek; C. A. Tyler, secretary, Nottawa, and H. H. Hinds, Stanton. G. W. Dunphy, V. S., Quincy, is State Veterinarian.

The following concerning tuberculosis, from our last report, may be of interest to many farmers, being a brief description of this disease and the operation of the tuberculin test, as furnished by the writer:

TUBERCULOSIS.

Since the Sixth Biennial Report was issued, this commission has applied the tuberculin test to nearly 1,000 head of cattle, a goodly proportion being milch cows. In fact, a larger number of cattle have been tested for tuberculosis during the last two years than had previously been tested since the tuberculin test was adopted by the commission.

The tuberculin test is applied only when suspicion is directed toward, or complaint made of, either a single animal or an entire herd. The records of tests made show but a small per cent of infected animals, and when we consider the fact that only suspicious herds are tested, we feel safe in estimating that less than two per cent of the cattle in Michigan are affected with tuberculosis.

In following the plan of testing cattle with tuberculin to detect the presence of tuberculosis, a wide general field has been covered. We have tested suspicious herds scattered from the south line of the State to the shores of Lake Superior and the extreme western line of the upper peninsula. The experience obtained is a repetition of the experience of all investigations. That is, that this disease is highly contagious among cattle in the latitude and longitude of all the State of Michigan where herds are kept under favorable environments for its propagation and spread. No breed of cattle are exempt from its ravages. The contagious character of tuberculosis among cattle has been proven beyond a doubt in a multitude of individual cases throughout the country. This commission is actively engaged in suppressing such outbreaks as are brought to its attention. It is our opinion that the cattle of the State are but little affected with this disease, but in herds where the disease has a foothold, and the conditions and environments are favorable to its development, a large percentage of the herd will be likely to be affected. We know of no cure for this disease, and have followed the policy of destroying or closely quarantining affected animals to arrest its farther spread.

Tuberculosis is the general name given to a class of diseases in animals of which consumption in the human family is a common type. This disease has been known ever since the advent of mankind, under many different names.

Tuberculosis in all its forms is caused by a specific microbe, and this microbe must be present ere this disease in its inception can come into existence. In 1882, Dr. Robert Koch, of Berlin, claimed the discovery and demonstrated the true and essential cause of tuberculosis—the tubercle bacillus. He also showed the bacillus present in all tubercular lesions. He isolated and cultivated the germs from tubercular tissue, and produced tuberculosis artificially in animals by inoculation with pure culture. At this time the doctor was looking for a cure for consumption in the human family.

He failed in this effort, but a few years later produced and experimented with a "lymph" or "tuberculin," which has since become a valuable diagnostic agent in demonstrating the presence of tuberculosis in animals, even in the early stages of the disease.

Regarding the list of micro-organisms, it is stated as an undeniable fact that the bacillus tuberculosis, although the most infinitesimal of them all (about one ten-thousandth of an inch in length), is at once a despot and a millionaire. It will live in ice, maintain vitality at a temperature below 150 degrees F., resists moisture, drouth and decay, and bids defiance to the germicidal action of the gastric juice. It is the czar of all mankind, and is responsible for more deaths among the human race than any other germ, while more people die annually from consumption than from war, pestilence and famine.

HOW TUBERCULIN IS MADE.

It is made from a pure culture of the tubercle bacillus, highly concentrated, then filtered through porcelain, after being sterilized by heating to a high temperature to destroy any and all germs. It is in liquid form, diluted with glycerine and carbolic acid, and is furnished to our commission by the Bureau of Animal Industry of the Department of Agriculture at Washington.

THE TEST.

In testing cattle for tuberculosis we take and record the average normal temperature of each animal during the first day. Several temperatures are taken, preferably two hours apart. The average normal temperature of cattle is about 101 degrees.

In the evening of the first day we inject two cubic centimeters under the skin of each full grown animal by means of a sterilized syringe. A smaller amount is injected into the system of younger animals, varying according to age and size. Commencing early the following morning, we take hourly temperatures of each injected animal during the day. Tuberculous cattle respond by a rise in temperature of two degrees or more from the twelfth to the twentieth hour after injection. A rise of two degrees over the normal temperature after injection indicates the presence of tuberculosis, unless there is some physical disturbance, such as the cows being in heat, near or recently past parturition; but if the animal is healthy, there should be no rise in temperature, and no possible injury to the cow.

During these tests the temperature is taken with tested or accurate thermometers. Much pains must be taken, and only experts should be allowed to make the tuberculin test. The hundreds of thousands of animals tested in this country, under the direction of competent veterinary surgeons have shown this test, as a diagnostic agent to be practically infallible in detecting the disease in the living animal.

The identity of tuberculosis in mankind and domestic animals being fully demonstrated, and being highly infectious, we now know that it is communicable from animals to animals, from animals to mankind, and from mankind to animals in return.

Tuberculin as a diagnostic agent is of incalculable value. At present we have no other sure means of detecting tuberculosis in cattle, even when well advanced.

HISTORY OF THE MICHIGAN DAIRYMEN'S ASSOCIATION.

SECRETARY WILSON.

In January, 1885, E. A. Stowe, editor of The Michigan Dairyman, issued a call for a meeting of dairymen to be held in Grand Rapids in February.

The meeting was well attended by representatives from every section of the State, who formed themselves into an organization to be known as The Michigan Dairymen's Association,

The dues were fixed at one dollar per annum, and thirty-three became members at this meeting. Officers were elected and the association started out in an enthusiastic manner.

NAMES OF CHARTER MEMBERS.

D. M. Adams, Ashland.
H. Dale Adams, Kalamazoo.
N. S. Andrews, Dubuque, Ia.
C. E. Belknap, Grand Rapids.
John Borst, Vriesland.
C. Case, Crystal.
D. P. Clay, Grand Rapids.
L. F. Cox, Portage.
C. Cross, Carson City.
D. Cunningham, Hudsonville.
R. P. Emerson, Kalamazoo.
A. P. Foltz, Davison.
S. L. Fuller, Grand Rapids.
E. A. Haven, Bloomingdale.
Warren Haven, Bloomingdale.
B. P. Dean, Cedar Springs.
W. H. Howe, Capac.
Frank J. Lamb, Grand Rapids.
C. B. Lambert, East Saginaw.
W. S. Luther, Ossian, Iowa.
R. C. Nash, Hilliards.
Frank E. Pickett, Hilliards.
J. Van Putten, Jr., Holland.
Frank Richmond, Saranac.
F. A. Rockafellow, Carson City.
M. P. Shields, Hilliards.
Geo. Sinclair, Hudsonville.
Jas. Skinner, Davison.
E. A. Stowe, Grand Rapids.
Martin L. Sweet, Grand Rapids.
O. Van Buren, Grand Rapids.
M. Wiggins, Bloomingdale
Victor C. Vaughan, Ann Arbor.
S. J. Wilson, Flint.

ANNUAL MEETING AND OFFICERS ELECTED.

1	1885.	Grand Rapids	Milo Wiggins elected president.	E. A. Stowe elected sec'y. and trea.
2	1886.	Kalamazoo	Geo. B. Horton “ “	“ “ “ “ “ “
3	1887.	Flint	“ “ “ “ “	“ “ “ “ “ “
4	1888.	Adrian	“ “ “ “ “	“ “ “ “ “ “
5	1889.	Jackson	“ “ “ “ “	“ “ “ “ “ “
6	1890.	Allegan	“ “ “ “ “	“ “ “ “ “ “
7	1891.	Lansing	E. N. Bates “ “	“ “ “ “ “ “
8	1892.	St. Johns	“ “ “ “ “	Jas. Slocum “ “ “ He resigned in September and S. J. Wilson was appointed.
9	1893.	Flint	“ “ “ “ “	S. J. Wilson elected sec'y. and trea.
10	1894	Saginaw	“ “ “ “ “	“ “ “ “ “ “
11	1895.	Adrian	Jas. N. McBride “ “	“ “ “ “ “ “
12	1896.	Lansing	“ “ “ “ “	“ “ “ “ “ “
13	1897.	Charlotte	“ “ “ “ “	“ “ “ “ “ “
14	1898.	Ypsilanti	E. A. Haven “ “	“ “ “ “ “ “
15	1899.	Grand Rapids	“ “ “ “ “	“ “ “ “ “ “

It will be seen from the above that Milo Wiggins held the presidency for one year, Geo. B. Horton for five years, E. N. Bates for four years, Jas. N. McBride for three years, and E. A. Haven, the present incumbent, for two years.

E. A. Stowe was secretary and treasurer for seven years, Jas. Slocum for seven months, and S. J. Wilson, the present incumbent, for a little over seven years.

About the time our association was organized, Davis and Rankin of Chicago were putting in creameries all over the State at exorbitant prices without any regard to their future success. The decided stand taken against them by the association and its members soon drove them from the State, but not until after they had succeeded in selling a great many outfits, and erecting creameries where they have proved to be total failures. The idle creameries over the State are principally of their building, and are monuments to one of the greatest frauds ever perpetrated upon the public. The failure of so many of these creameries gave the dairy business in this State a hard blow, from which it has not fully recovered. There is no doubt but what our association saved the farmers thousands of dollars by exposing their methods and helping to drive them from the State.

The next important question that came before us was the adulteration of butter and cheese. This was brought up at our third meeting. Resolutions were passed asking for the necessary legislation to prevent the same. Nothing was accomplished until just prior to the election of 1896, when the officers and chairman of the legislative committee secured pledges from the nominees of both parties that they would vote for the anti-color law, or such a measure as our association would endorse. Enough of the members kept the pledge so that the anti-color bill was passed. But owing to an inexcusable blunder of the engrossing clerk, the title of the bill was left off, and the law was declared invalid.

At the fourth meeting the question of branding the cheese was discussed and referred to a committee, who reported at our fifth meeting, the result of which was the passage of the law we now have in regard to the branding cheese as full cream.

In the year of 1886 or 1887 the secretary, Mr. Stowe, began to correspond with some of the members, and to agitate through his paper the question of securing what is now called the Dairy and Food Commission and the laws relating thereto. No formal action was taken, however, until our fifth meeting, when resolutions were passed and a memorial was presented to the Senate and House, asking them to pass such a measure.

The agitation was kept up at each meeting thereafter, until the legislature of 1893 finally granted our requests, by passing the pure food laws and creating the office of Dairy and Food Commissioner.

The Michigan Dairymen's Association was the first to agitate this question, and the creation of this office and the passage of the pure food laws are largely due to its work.

The association and the State Board of Agriculture have always worked together to advance the dairy interests of the State, and when, in our early history, we passed resolutions asking that more dairy instructions be given at the college, they readily acceded to our requests by employing a professor well versed in this branch of agriculture, who has been with us at our meetings and has lifted up his voice there, and at the institutes all over the State, in the interests of better dairy education.

We also have put forth every effort to have a suitable dairy building put up at the college, where modern dairying can be taught in all its branches.

April 26, 1895, an act was passed under which the association became incorporated. The incorporators were Jas. N. McBride, Owosso; Samuel J. Wilson, Flint; John I. Breck, Jackson; Clinton D. Smith, Agricultural College; George B. Horton, Fruit Ridge; Earnest A. Stowe, Grand Rapids; Erastus N. Bates, Moline.

The same legislature passed an appropriation act giving the association $1,000 per year for two years. This money was largely expended by sending expert butter makers to the State and county fairs, to act as judges of dairy products, and to give instructions in making butter. Samples of butter and milk outside of the regular exhibits were tested, and object lessons were given which were well received. This resulted in much good to the localities visited, many of the fair associations requesting us to continue the work after the appropriation for it was exhausted.

The association took an active part with the dairy organizations of other States in securing the passage by Congress of the filled cheese bill, taxing filled cheese.

The annual meetings are held in the month of February each year, and are usually of three days' duration. A program is always prepared, and papers have been presented by men of national repute from other states, as well as the best dairymen in our own State. The topics cover every phase of the dairy question, and the discussions have been along a most intelligent line, showing that our dairymen are seeking information to make themselves more proficient in their chosen calling.

An exhibit of dairy goods and dairy products has always been held in connection with our annual meetings, which is becoming more popular each year. The manufacturers of dairy goods have generously contributed special premiums to be competed for in all classes, so that there has been a strong competition for the premiums.

We believe, however, that the dairymen value the score they receive at the hands of our judges far more than any premiums offered.

In the year 1887 the legislature passed an act permitting the association to have 3,000 copies of their annual report printed by the State. Since that time a stenographer has been employed who has taken down a full report, which has been published and distributed among the dairymen of the State.

The benefits derived from this can be better estimated by examining the reports of our annual meetings. The papers are more carefully and intelligently prepared, and the dairymen are more eager to ask questions and to have every point fully discussed, which shows a rapid growth of interest and of dairy knowledge, which could not have been brought about in any other way. A comparison of the products of our factories and dairies with fifteen years ago will also show that our labors have not been in vain in elevating the standard of Michigan dairy products.

The association has a membership of about four hundred, of which only about one hundred pay their annual dues, which is not sufficient to enable them to do any extended work outside of what their enthusiasm leads them to.

They have struggled through the straits of financial adversity year after year, barely collecting enough to meet expenses, many times not even that, the officers generously paying whatever shortage occurred, trusting and hoping for brighter times, but never despairing.

Their labors have at last been rewarded by the last legislature passing an act giving them an appropriation of $300.00 per year to gather dairy statistics and mail the reports.

The officers and active members of this association have all been enthusiastic dairymen, whose names will be passed down to future generations as the pioneers of modern dairying in the State. Their writings and sayings will be compared with those of eminent dairymen of other States. Then, and only then, will their efforts in creating and keeping up this organization be fully appreciated.

COMMERCIAL FERTILIZERS IN MICHIGAN.

COLON C. LILLIE, M. A. C., '84.

Commercial fertilizers have been used in some parts of Michigan for the last quarter of a century. Their use has increased slowly, but at present they are surely gaining favor. They are not used at all in some portions of the State, while in other sections they are used quite extensively. This fact would seem to indicate that they give better results on some soils than on others, and some people believe that on some soils no benefit can be derived by their use. But their extensive use in some parts of the State, and their slight use in other portions is certainly not all due to this difference in the character of the soil. It is the opinion of the writer that as the State grows older and the subject becomes more thoroughly investigated by the farmers, this idea that certain kinds of soil will not respond to their use will largely if not wholly vanish.

CAUSE OF SLOW AND SECTIONAL GROWTH.

Some of the causes which may be stated for the slow extension as well as sectional use of fertilizers in Michigan are the following:

First, Our State has a great diversity of soil—some very fertile soil and some not so fertile. Some of it is quite moist, holds moisture well, and some is dry or parts with its moisture readily. Our prairies, bottom lands and oak openings have proven to be wonderfully lasting. For many years they did not show the need of added fertility in order to produce profitable crops. Indeed, even now, where the land has been carefully handled, splendid crops can be grown without the use of fertilizers.

Second, The farmers of Michigan have to a great extent always practiced a diversified agriculture. No one crop has been raised year after year, to the great detriment of soil fertility, but in the main a rotation of crops has been practiced. The clover plant, too, in some localities, thanks to the teaching of Dr. Kedzie, has played no small part in postponing the day when the Michigan farmer would feel the necessity of purchasing commercial fertilizers. Stock raising and feeding, also, has in some sections contributed its share in maintaining the fertility of the soil by returning to the soil in stable manure a portion of the plant food necessarily taken from it by the growth of plants. The fact remains, however, that many of our best farmers in various parts of the State find the regular and systematic use of commercial fertilizers profitable, and, paradoxical as it may seem, these farmers are just the ones that take the most pains to save and apply all farm manures.

Third, Another and not the least important cause is found in the fact that Michigan did not pass a law for the inspection of fertilizers until the year 1885. Previous to that time, and more particularly at just about that time, this State was the dumping ground for fraudulent, worthless fertilizers. Dr. Kedzie found that in one instance soap boilers' waste and leached ashes was sold as a high grade superphosphate. In another instance marl was shipped in from Ohio as Buckeye Phosphate. In still another instance furnace slag and salt was represented as a high grade fertilizer. The writer had a little personal experience with what was known as "Western Reserve" fertilizer, which, both upon analysis and trial, was found to be practically worthless. Now, when a man bought some of these kinds of goods, having had no previous experience with fertilizers and thinking them all alike, he became disgusted with commercial fertilizers and stamped them all as a fraud, and to this day some who were thus defrauded in various parts of the State can not even be induced to try fertilizers as an experiment.

WHERE USED.

The use of fertilizers may be said to be general, that is, nearly every farmer uses it, in the eastern and southeastern portion of the State. Here fertilizers have come to stay. Their use is beyond the experimental stage, and a majority of the farmers have settled down to the policy of using them systematically. Scattered all over the State are individual farmers who use fertilizers regularly, and in many localities their use is quite general in particular neighborhoods.

ON WHAT CROPS USED.

The great bulk of all the fertilizers used in Michigan is applied to the wheat crop at the time of seeding in the fall. One principal reason for this is that the wheat crop by too many farmers is considered by them as the money crop, and anything that will increase the yield of wheat increases the cash income and debt paying power of the farm. Until quite lately the use of fertilizer in the spring was confined largely to market gardeners and fruit growers, but farmers are beginning to use it on oats, corn, potatoes and sugar beets. The use of fertilizers on potatoes would be largely increased could anything like a fair market price for the product be assured.

PER CENT OF FARMERS USING FERTILIZERS.

The Michigan crop report for July, 1899, gives the per cent of farmers using fertilizers in the southern counties as ten, the central counties four, the northern counties one, and for the whole State seven. Had the State been divided geographically into eastern, central and western counties, it would have been found that quite a large per cent of the farmers in the eastern counties use fertilizers.

PERSONAL EXPERIENCE.

The writer began the use of commercial fertilizers in a very cautious way, purchasing in the fall of 1887 three sacks (600 pounds), simply to test their value on wheat. One of the sacks was the "Western Reserve" fertilizer above referred to. No results could be observed from the use of this brand, neither in the growth of straw or length of head, or plumpness of berry. The other brand (Homestead) produced gratifying results. The sacks were sown on separate fields on a strip through the middle of the field, and at the rate of 200 pounds per acre. The wheat made a better growth from the start on these strips. The straw was taller, the heads longer and better filled, and the berry was plumper and had a more glossy appearance. It was simply astonishing to note what results so little fertilizer would produce. A portion of one field had been top-dressed with barnyard manure. The fertilizer was applied crosswise of this, so that it extended over the manured as well as the unmanured portion. It was a surprise to note that the fertilizer produced as marked a difference in the growth of wheat on the manured portion as on that portion not manured. The portion of the field top-dressed with manure produced a better crop of wheat than the unmanured, but the fertilized strip was seemingly proportionally better also. This seemed to indicate that one need not be afraid to apply a little plant food to even fairly good land.

In the fall of '88, two tons of fertilizer (analysis, 2¼ to 3.15 per cent ammonia, 8 to 11 per cent phosphoric acid, and 1.5 to 2 per cent actual potash) was used on wheat at the rate of 200 pounds per acre. Strips the width of the drill were left regularly through the field where no fertilizer was sown, so that results could be noted. It did not take a threshing test to convince any one that profitable results were obtained. Conservative people estimated that the fertilizer made a difference of from 10 to 15 bushels per acre. Fertilizer has been used regularly since on the wheat crop, and it is believed always with a profit.

USE ON A RUN-DOWN FARM.

A run-down farm was purchased in the winter of '88, and the value of fertilizer has been thoroughly tested as a supplement to clover in bringing up this land. The results have been greater than ever was expected.

Previous to the purchase, a catch of clover had not been obtained for years, and on some fields timothy even refused to grow. On one field in particular, four unsuccessful attempts had been made to get a stand of timothy. By the application of fertilizer, good enough crops were grown from the start to pay for the labor and interest on the investment, and fine stands of clover were secured at once, which were certainly not all due to tillage, as on strips left where no fertilizer was used the clover did not make nearly as strong a growth. Not a particle of barn-yard manure was used on this farm for the next eight years. No clover was ever plowed under, not even the second crop, so that all the plant food the farm received was in the clover roots and commercial fertilizer, yet the yield of crops gradually increased. Clover alone could not have made this investment profitable from the start. It is too slow. What was needed was something quick, and commercial fertilizer did the business.

A THRESHING TEST.

Hon. A. C. Bird, at present secretary of our State Agricultural College, used fertilizer as an experiment on wheat on his farm in Oakland county. The analysis of this fertilizer was 2 to 3 per cent ammonia, 10 to 12 per cent phosphoric acid, and 2 to 3 per cent actual potash. The fertilizer was applied on one side of a large field and at the averate rate of about 200 pounds per acre. The wheat was kept separate from the rest and yielded at the rate of 39 bushels per acre. That portion of the field not fertilized yielded 32 bushels, giving 6½ bushels in favor of the fertilizer. The retail price of the fertilizer to the farmer was $22.00 per ton, or $2.20 per acre. The price of wheat at Highland the day Mr. Bird threshed was 65 cents per bushel, and the 6½ bushels would therefore be worth $4.22½. Deducting the cost of the fertilizer per acre, $2.20, leaves a profit of $2.02½, provided no charge is made for applying the fertilizer. This would give 92 per cent interest on the $2.20 invested in fertilizer.

The writer had the opportunity of seeing this field of wheat just before harvest, and it is safe to say that the casual observer would never have detected that a portion of the field was fertilized. The effect on this soil was unlike that on the heavier soil of Ottawa county. There was no extra length of straw, but on close inspection the heads seemed to be heavier and better filled—they bent over a little more. This experiment leads the writer to believe that in some instances, at least, fertilizer has been declared unprofitable when it probably was profitable. On such soil and a like season only the threshing test can decide.

FERTILIZERS ON FRUIT.

As yet fertilizers have not been used extensively in Michigan on fruit. Fruit trees are of a comparatively slow growth and their roots, extending deep down into the soil, have a broad pasturage. Hence, on good soil, it is a number of years before the need of extra plant food is manifest. Many of our best fruit growers, however, have had profitable results from their use. Among others may be mentioned Mr. Roland Morrill of Benton Harbor, Hon. Robt. Graham of Grand Rapids, and C. F. Hale of Shelby, as having had satisfactory results from the use of fertilizer on peaches, the quality being greatly improved.

Mr. Homer Hayes of Tallmadge and B. F. Pixley of St. Joseph have had very flattering results from the applications of commercial fertilizers on Niagara grapes. Some definite data are at hand from Mr. Pixley. He planted two-thirds of an acre of Niagara grapes on rather light, sandy soil. When these vines came to bearing the fruit would fall off before it was thoroughly ripe. Mr. Pixley wrote the nursery from whom he obtained the trees and they advised him to use phosphoric acid and potash in liberal quantities. He did so, and the results have been most gratifying. The vineyard responded from the first application, and the fruit has increased in quantity and greatly improved in quality. Last year, 1898, Mr. Pixley marketed from his two-thirds of an acre 14,000 pounds of grapes, and the quality was such that they very readily sold in the Chicago market for $1.00 per crate of six four-pound baskets. The two-thirds acre netted him actual profit, after deducting all expenses, $234.50.

THE RATIONAL USE OF FERTILIZERS.

To grow a single crop continuously year after year, as wheat, and supply the needed plant food by heavy applications of commercial fertilizer may make a few quick dollars, but it will not pay in the long run. It gets the soil out of condition, robs it of its humus, its very life, and then one loses control of his business. Under very favorable conditions he may grow profitable crops, but a soil greatly reduced in humus may be likened to a ship at sea with a very poor rudder. If there is no strong wind or current she may be steered safely into harbor without much difficulty, but let the wind or adverse current come and she is well nigh unmanageable. Now, a soil devoid of humus, even though supplied with soluble plant food, can not be depended upon when in a poor season. Let the drouth come and the soluble food amounts to but little. So, too, if the season is exceptionally wet, the soil does not seem to have the power to care for the surplus water, but with sufficient humus the soil seems to have power to resist to a marked degree either of these adverse cirsumstances.

The rotation of crops must be taken into consideration in the rational use of commercial fertilizer. In a four years' rotation of clover, corn, oats and wheat it will usually be profitable to fertilize both the oat and wheat crop, the wheat, of course, being seeded to clover. Our own rotation of clover, corn and wheat is, of course, not adapted to any but a dairy or stock farm. All of the stable manure is applied to the clover sod for corn, except that made during the spring and summer, which is used to top dress the thin places in the permanent pasture and the poor spots in the new seeding of clover. It is believed that no better use of stable manure can be made than to haul it from day to day as it accumulates and spread it on the clover sod to be turned down for corn. Stable manure is rich in nitrogen, and the corn plant needs it. Nitrification takes place rapidly in a well cultivated corn field in hot weather, and this is just the time when the corn plant makes its most rapid growth. This system of course leaves no stable manure for the wheat crop and, therefore, commercial fertilizers are used. If one's land is already in a fair state of fertility perhaps, with this system, but very little or no nitrogen need be purchased. This will lessen the fertilizer bill perceptibly, as nitrogen is the most costly part of the fertilizer. But if the land is being built up, the crop-bearing power increased, nitrogen can hardly be dispensed with. Phosphoric acid and potash will nearly always pay on wheat which is to be followed with clover, for what the wheat does not need, the clover will.

By a little experimenting the farmer can determine in what particular element his soil is deficient. Apply potash to one strip, phosphoric acid to another, and nitrogen to another, and note the results. If the crop responds to one element more than to another, feed the crop what it wants and it will pay. A complete fertilizer, particularly rich in this element may be used, or the element may be applied separately. Only by experimenting can the farmer use fertilizer intelligently. Ask the crop what it wants. It will answer willingly, and then supply this want.

If, however, the plant asks for phosphoric acid, for instance, and is supplied with this, after a time it may be necessary also to supply potash, as the extra crops raised may lower the available supply of this element, and perhaps nitrogen as well.

FERTILIZERS VS. BARNYARD MANURE.

Farmers aften ask the question, "Are fertilizers as good as barnyard manure?" This certainly must be answered in the negative. They are not. Barnyard manure not only furnishes food for the plants, but supplies vegetable matter for humus in the soil, and therefore improves the mechanical condition of the soil. Fertilizer, however, acts quicker and is better to start some crops. But why compare fertilizer with barnyard manure? Liebig long ago said: "The manure produced in the course of husbandry is not sufficient to maintain permanently the fertility of the farm; it lacks the constituents which are annually sold off in the shape of grain, hay, milk and live stock." This is just as true today as it was then, and every observing farmer sees it. Barnyard manure is all right if only enough of it can be procured, but enough is not to be had, and it is simply a question whether a portion of the crops shall go unfertilized or commercial fertilizer be purchased.

Again, barnyard manures are comparatively rich in nitrogen, and if fertilizers are purchased which are rich in the mineral elements, the barnyard manure may be applied thinner and cover a larger area and supplemented with fertilizer.

COMMERCIAL FERTILIZER VS. CLOVER.

Like barnyard manure, it should not be fertilizer vs. clover, but fertilizer and clover. The great value of the clover plant in this latitude is not fully appreciated. It gathers nitrogen from the air, pumps from the subsoil phosphoric acid and potash, and greatly improves the mechanical condition of the soil, especially of heavy lands. Its work is slow. Nature has plenty of time. We must wait for our returns. On most soils the growth of clover is improved by applications of phosphoric acid and potash, and in many instances a little available nitrogen gives it a quick start.

On land that has been farmed for 30 to 40 years, a farmer's success is measured by the amount of manure at his command. With plenty of manure he can thrive, without it he must starve. He has practically three sources from which to draw, viz: (1) barnyard manure, (2) clover, (3) commercial fertilizers. When only one of these sources is used, it may be compared to a one-horse team. Harness two of them together and you have a double team. Barnyard manure and clover make a slow and somewhat awkward team. Fertilizer harnessed with either clover of barnyard manure makes a much handier team and they can do more work. But harness all three sources together and the farmer has a three-horse team that pull together and pull willingly, and they make him master of the situation.

MISCELLANEOUS.

SKETCH OF MANLY MILES.

FROM POPULAR SCIENCE MONTHLY, APRIL, 1899.

To Dr. Manly Miles belongs the distinction of having been the first professor of practical agriculture in the United States, as he was appointed to that then newly instituted position in the Michigan Agricultural College in 1865.

Professor Miles was born in Homer, Cortland county, New York, July 20, 1826, the son of Manly Miles, a soldier of the Revolution; while his mother, Mary Cushman, was a lineal descendant of Miles Standish and Thomas Cushman, whose father, Joshua Cushman, joined the Mayflower colony at Plymouth, Massachusetts, in 1621, left him there with Governor Bradford when he returned to England.

When Manly, the son, was eleven years old, the family removed to Flint, Michigan, where he employed his time in farm work and the acquisition of knowledge, and later in teaching. He had a common school education, and improved all the time he could spare from his regular occupations in reading and study. It is recorded of him in those days that he was always successful in whatever he undertook. In illustration of the skill and thoroughness with which he performed his tasks, his sister relates an incident of his sowing plaster for the first time, when his father expressed pleasure at his having distributed the lime so evenly and so well. It appears that he did not spare himself in doing the work, for so completely was he covered that he is said to have looked like a plaster cast, "with only his bright eyes shining through." A threshing machine was brought on to the farm, and Manly and his brother went round threshing for the neighbors. Industrious in study as well as in work, the boy never neglected his more prosaic duties to gratify his thirst for knowledge. He studied geometry while following the plow, drawing the problems on a shingle, which he tacked to the plow-beam. Whenever he was missed and inquiry was made about him, the answer invariably was, "Somewhere with a book." He was most interested in the natural sciences, particularly in chemistry in its applications to agriculture, and in comparative physiology and anatomy, and was a diligent student and collector of mollusks.

Choosing the profession of medicine, Mr. Miles was graduated M. D. from Rush Medical College, Chicago, in 1850, and practiced till 1859. In the meantime he became greatly interested in the subject of a geographical survey of the State, for which an act was passed and approved in 1858. In the organization of the survey, in 1859, he was appointed Assistant State Geologist in the department of zoölogy; and in the next year was appointed professor of zoölogy and animal physiology in State Agricultural College at Lansing.

In his work as zoölogist to the State Geological Survey, in 1859, 1860, and 1861, he displayed rare qualities as a naturalist, so that Mr. Walter B. Barrows, in recording his death in the bulletin of the Michigan Ornithological Club, expresses regret that many of the years he afterward devoted to the development of experimental agriculture "were not spent in unraveling some of the important biological problems which the State afforded, which his skill and preservance would surely have solved." He was a "born collector," Mr. Barrows adds, "as the phrase is, and his keen eyes, tireless industry, and mathematical precision led to the accumulation of thousands of valuable specimens and more valuable observations."

Mr. Bryant Walker, of Detroit, who knew Professor Miles well in later years, and had opportunity to review his zoölogical work, regards the part he took during this sevice in developing the knowledge of the fauna of the State as having been very prominent. "The catalogues he published in the report for 1860 have been the basis for all work since that time." He kept in correspondence with the most eminent American naturalists of the period, including Cope, Prime, Lea, W. G. Binney, Baird, and Agassiz, and supplied them with large quantities of valuable material. From the many letters written by these naturalists which are in the possession of his friends, we take, as illustrating the character of the service he rendered and of the trust they reposed in him, even previous to his going on the survey, one from Agassiz, of February 4, 1856:

"Dear Sir: As you have already furnished me with invaluable materials for the natural history of the fishes of your State, I am emboldened to ask another favor of you. I am preparing a map of the Geographical Distribution of the Turtles of North America, and would be greatly indebted to you for any information respecting the range of those found in your State, as far as you have noticed them, even if you should know them only by their common names, my object being simply to ascertain how far they extend over different parts of the country. If you could add specimens of them, to identify them with precision, it would be, of course, so much the better; but as I am almost ready for the press, I could not for this paper await the return of spring, but would thank you for what you could furnish me now. I am particularly interested in ascertaining how far north the different species inhabiting this continent extend." On the back of this letter was Dr. Miles' indorsement that a box had been sent.

A number of letters from Professor Baird, of 1860 and 1861, relate to the identification of specimens collected by Dr. Miles, and to the fishes of Michigan, and contain inquiries about gulls and eggs. Dr. Miles likewise supplied Cope with a considerable amount of material concerning Michigan reptiles and fishes.

While mollusks were the favorite object of Dr. Miles' investigations, he also made studies and valuable collections of birds, mammals, reptiles, and fishes; and he seems, Mr. Barrows says, "to have possessed, in a high degree, that strong characteristic of a true naturalist, a full appreciation of the value of good specimens. Many of his specimens are now preserved at the Agricultural College, and among his shells are many which are of more than ordinary value from having served as types of new species, or as specimens from type localities, or as part or all of the material which has helped to clear up mistakes and misconceptions about species and their distribution." Mr. Walker speaks of his having done a great work in conchology. His catalogue, which contained a list of one hundred and sixty-one species, was by far the most complete published up to that time. "He described two new species—*Planorbis truncatus* and *Unio leprosus*. The former is one of the few species which are, so far as known, peculiar to Michigan, and is a very beautiful and distinct form; while the latter, although now considered as synonymous with another species, has peculiarities which in the then slight knowledge of the variability of the species was a justification of his position. He was also the discoverer of two other forms which were named after him by one of our most eminent conchologists—viz., *Campeloma Milesii* (Lea) and *Guiogasis Milesii* (Lea)." Mr. Walker believes that " in general, it can be truthfully stated that Dr. Miles did more to develop the general natural history of that State (Michigan) than any other man either before or since he completed his work as State Geologist."

As professor of zoölogy and animal physiology, Dr. Miles is described by one of his students, who afterward became a professor in the College and then its president, as having been thoroughly interested in the subjects he taught, and shown that interest in his work and in his treatment of his students. He labored as faithfully and industriously with the class of five to which President Clute belonged as if it "had numbered as many score." He supplemented the meager equipment of his department from his more extensive private apparatus and collections, which were freely used for class work; and, when there was need, he had the skill to prepare new pieces of apparatus. "He was on the alert for every chance for illustration which occasion offered; an animal slaughtered for the tables gave him an opportunity to lecture on its viscera; a walk over the drift-covered fields found many specimens of rock, which he taught us to distinguish; the mud and the sand banks along the river showed how in the periods of the dim past were formed fossil footprints and ripples; the woods and swamps and lakes gave many useful living specimens, some of which became the material for the improvised dissecting room; the crayon in his hand produced on board or paper the chart of geologic ages, the table of classification, or the drawing of the part of an animal under discussion."

Prof R. C. Kedzie came to the College a little later, in 1863, when Dr. Miles had been for two years a professor, and found him then the authority "for professors and students alike on beasts, birds, and reptiles, on the stones of the field, and insects of the air," thorough, scholarly, and enthusiastic, and therefore very popular with his classes.

The projection of agricultural colleges under the Agricultural College Land Grant Act of 1862 stimulated a demand for teachers of scientific agriculture, and it was found that they were rare. Of old school students of science there was no lack—able men, as President Clute well says, who were familiar with their little laboratories and with the old theories and methods, but who did not possess the new vision of evolution and the conservation of energy, men of the study rather than the field, and least of all men of the orchard and stock farm; and they knew nothing of the practical application of chemistry to fertilization and the raising of crops and the composition of feed stuffs, of physiology to stock-breeding, and of geology and physics to the study of the soils.

With a thorough knowledge of science and familiarity with practical agriculture Professor Miles had an inclination to enter this field, and this inclination was encouraged by President Abbot and some of the members of the Board of Agriculture. He had filled the professorship of zoölogy and animal physiology with complete success, and had he consulted his most cherished tastes alone he would have remained there, but he gradually suffered himself to be called to another field. The duties of "acting superintendent of the farm" were attached to his chair in 1864. In 1865 he became professor of animal physiology and practical agriculture and superintendent of the farm; in 1869 he ceased to teach physiology, and gave his whole time to the agricultural branch of his work; and in 1875 the work of the superintendent of the farm was consigned to other hands, and he confined himself to the professorship proper of practical agriculture.

The farm and its appurtenances, with fields cumbered with stumps and undrained, with inadequate and poorly constructed buildings, with inferior live stock, and everything primitive, were in poor condition for the teaching or the successful practice of agriculture. Professor Miles' first business was to set these things in order. Year by year something was done to remove evils or improve existing features in some of the departments of the life and management of the premises, till the concern in a certain measure approached the superintendent's ideal—as being a laboratory for teaching agriculture, conducting experiments, and training men, rather than a money-making establishment.

In this new field, Professor Kedzie says, Professor Miles was even more popular than before with students, and created an enthusiasm for operations and labors of the farm which had been regarded before as a disagreeable drudgery. The students "were never happier than when detailed for a day's work with Dr. Miles in laying out some difficult ditch or surveying some field. One reason why he was so popular was that he was not afraid of soiling his hands. His favorite uniform for field work was a pair of brown overalls. The late Judge Tenney came to a gang of students at work on a troublesome ditch and inquired where he could find Dr. Miles. 'That man in overalls down in the quicksands of the ditch is Dr. Miles'; the professor of practical agriculture was in touch with the soil."

Prof. Byron D. Halsted, of the New Jersey Agricultural College Experiment Station, who was an agricultural pupil of Dr. Miles in Lansing, characterizes him as having been a full man who knew his subjects deeply and fondly. "In those days I am safe in writing that he represented the forefront of advanced agriculture in America. He was in close touch with such men as Lawes and Gilbert, Rothamstead, England, the famous field-crop experimenters of the world, and as for his knowledge of breeds of live stock and their origin, Miles' Stock-Breeding is a classic work. Dr. Miles, in short, was a close student, a born investigator, hating an error, but using it as a stepping stone toward truth. He did American farming a lasting service, and his deeds live after him."

While loved by his students, most of whom have been successful and many have gained eminence as agricultural professors or workers in Experiment Stations, and while receiving sympathy and support from President Abbot, Dr. Miles was not appreciated by the politicians, or by all of the Board of Agriculture, or even by the public at large. Unkind and captious criticisms were made of his work, and it was found fault with on economical grounds, as if its prime purpose had been to make money. He therefore resigned his position in 1875, and accepted the professorship of agriculture in the Illinois State University. Thence he removed to the Houghton Farm of Lawson Valentine, near Mountainville, N. Y., where he occupied himself with scientific experimental investigation. He was afterward professor of agriculture in the Massachusetts Agricultural College, at Amherst. In announcing this appointment to the students, Dr. Chadbourne, then president of the institution, and himself a most successful teacher, stated that he considered Dr. Miles as the ablest man in the United States for that position. In 1886, shortly after Dr. Cladbourne's death, Dr. Miles returned to his old home in Lansing, Michigan, where he spent the rest of his life in study, research, and the writing of books and articles for scientific publications.

During these later years of his life he took up again with what had been his favorite pursuit in earlier days, but with which he had not occupied himself for thirty years—the study of mollusks—with the enthusiasm of a young man, Mr. Walker says, who being interested in the same study, was in constant correspondence with him at this time; "and as far as his strength permitted labored with all the acumen and attention to details which were so characteristic of him. I was particularly struck with his familiarity with the present drift of scientific investigation and thought, and his thorough appreciation of modern methods of work. He was greatly interested in the work I was carrying on with reference to the geographical distribution of the mollusca, and, as would naturally be supposed from his own work in heredity in connection with our domestic animals, took great pleasure in discussing the relations of the species as they are now found and their possible lines of descent. He was a careful and accurate observer of Nature, and if he had not drifted into other lines of work would undoutedly have made his mark as a great naturalist. As it is, his name will always have an honored place in the scientific history of Michigan."

When Professor Miles began to teach in the Michigan Agricultural College, the "new education" was new indeed, and the text-book method still held sway. But the improved methods were gradually taking the place of the old ones, and Professor Miles was one of the first to coöperate in them, and he did it with effect. He used text-books, "but his living word," President Clute says, "supplemented the book; and the animal from the farm under his knife and ours, the shells which he led us to find under the rotten logs and along the rivers and lakes, the insects he taught us to collect and classify, the minerals and fossils he had collected on the geological survey of Michigan, all were used to instruct and inspire his students, to cultivate in them the scientific spirit and method."

Among the more important books by Professor Miles are Stock-Breeding, which had a wide circulation and has been much used as a class-book; Experiments with Indian Corn, giving the results of some important work which he did at Houghton Farm; Silos and Ensilage, which helped much in diffusing knowledge of the silo in the times when it had to fight for recognition; and Land Drainage. Of his papers, he published in the Popular Science Monthly articles on Scientific Farming at Rothamstead; Ensilage and Fermentation; Lines of Progress in Agriculture; Progress in Agricultural Science; and How Plants and Animals Grow. To the American Association for the Advancement of Science he contributed papers on Energy as a Factor in Rural Economy; Heredity of Acquired Characters (also to the American Naturalist); Surface Tension of Water and Evaporation; Energy as a Factor in Nutrition; and Limits of Biological Experiments (also to the American Naturalist). Other articles in the American Naturalist were on Animal Mechanics and the Relative Efficiency of Animals as Machines. In the Proceedings of the American Educational Association is an address by him on Instruction in Manual Arts in Connection with Scientific Studies. The records of the U and I Club, of Lansing, of which he was a valued member for ten years, contain papers on a variety of scientific subjects which were read before it, and were highly appreciated. This list does not contain all of Professor Miles' contributions to the literature of science, for throughout his life he was a frequent contributor to the agricultural and scientific press, and a frequent speaker before associations and institutes, "where his lectures were able and practical."

No special record is made of the work of Professor Miles in the American Agriculturist, but the correspondence of Professor Thurber with him furnishes ample proof that he was one of the most trusted advisers in the editorial conduct of that journal. The familiar tone of Professor Thurber's letters, and the undoubting assurance with which he asked for information and aid on various subjects, well demonstrate how well the editor knew whom he could rely upon in an emergency.

In all his work the great desire of Professor Miles was to find and present the truth. His merits were recognized by many scientific societies. He was made a corresponding member of the Buffalo Society of Natural Sciences in 1862; a corresponding member of the Entomological Society of Natural Sciences in 1862; a corresponding member of the Entomological Society of Philadelphia in January, 1863; a correspondent of the Academy of Natural Sciences of Philadelphia in 1864; a member of the American Association for the Advancement of Science in 1880, and a Fellow of the same body in 1890; and held memberships or other relations with other societies; and he received the degree of D. V. S. from Columbia Veterinary College, New York, in March, 1880.

His students and friends speak in term of high admiration of the genial qualities of Professor Miles as a companion. The resolutions of the U and I Club of Lansing describe him as an easy and graceful talker, a cheerful dispenser of his learning to others. "To spend an hour in his 'den,' and watch his delicate experiments with 'films,'" says President Clute, "and see the light in his eyes as he talked of them, was a delight." "He was particularly fond of boys," says another, "and never seemed happier than when in the company of boys or young men who were trying to study and to inform themselves, and if he could in any way assist them he was only too glad to do so;" and he liked pets and children. Incidents are related showing that he had a wonderful accuracy in noting and recollecting the minutes details that came under his observation—a power that he was able to bring to bear instantly when its exercise was called for.

Dr. Miles kept up his habits of reading and study to the last days of his life; but all public work was made difficult to him in later years by an increasing deafness. He was tireless in investigation, patient, and always cheerful and looking for the bright side; and when one inquired of him concerning his health, his usual answer was that he was "all right," or, if he could not say that, that he would be "all right tomorrow."

No sketch of Dr. Miles is complete without a word of tribute to his high personal character, his life pure and noble in every relationship, his unswerving devotion to truth, and the unfaltering loyalty to his friends, which make his memory a benediction and an inspiration to all who knew him well.

He was married in 1851 to Miss Mary E. Dodge, who remained his devoted companion until his death, while occurred February 15, 1898.

THE MICHIGAN STATE GRANGE.

SECRETARY BUELL.

The Michigan State Grange is the State union of 300 subordinate Granges, with a membership of 12,000. That farming communities are ready for organization is shown by the fact that in the year ending June 30, 1899, under the direction of State Grange, 47 new Granges have been organized in various sections of the Lower Peninsula represented by 22 counties.

There has been a gain of approximately 5,000 in the total membership. Greater activity is observed along all the lines of effort afforded by the order. The year marks a decided advance in buying and selling together. Patrons' Mutual Fire Insurance Companies have been established in several counties and others are in process of organizing. The literary programs throughout the Grange from year to year evidence a growth in thought and broadened grasp of general subjects of interest to agriculturists in common with all citizens.

STATE ASSOCIATION OF FARMERS' CLUBS.

SIXTH ANNUAL MEETING.

A. B. COOK SECRETARY.

To the Honorable State Board of Agriculture:

As Secretary of the State Association of Farmers' Clubs it becomes my duty to make the annual report of the work done by that association. The fifth annual meeting was held December 14 and 15, and was attended by about 200 delegates. The secretary reported fifty-four (54) new clubs, and a total of three hundred fifty (350) clubs in the State, with a membership of 30,000. A large part of one session was given up to the reports of delegates.

At the evening session of the first day President Cook delivered the annual address, which was as follows:

ANNUAL ADDRESS.

PRES. E. J. COOK, OF THE STATE ASSOCIATION.

With this meeting we place the key-stone in the fifth annual ring of State Association's history. With this meeting we round out the fifth of five years of associational activity. Good years these have been, freighted with results beyond the hopes of the most optimistic of our charter members.

February 4, 1894, we organized under our now well-known banner,—The Michigan State Association of Farmers' Clubs. Since that time our growth has been a steady and healthy one. I have no statistics prior to last year. One year ago Secretary Wells reported thirty clubs organized during the year, while this year Secretary Pierce reports over fifty new clubs, showing that the club movement gains strength with age.

The number of clubs in the State is in nowise represented by the number enrolled as members of the State Association. It is with keen regret that I make this statement. Not until every club in our State is a member of the association and is represented at the annual meeting by able representative delegates will we exert our maximum of influence.

Our condition in the State today is, it seems to me, most prosperous, and the reason is most obvious. The necessity of organization in our vocation is universally admitted. Much as we dislike to, we are obliged to admit that as a whole the farming classes have fallen behind in the forward march of human advancement. This is a direct result of the isolated life of the farmer. The merchant of our city steps to the telephone and in one instant is in direct communication with his fellow merchant, his customer, or it may be with his wholesale house in the distant city. So with all business conditions in centers of trade. Not so with the farmer. The very nature of his calling renders, under present conditions, communication slow and uncertain; hence organization is difficult, in fact the practicability of a sound organization among the agricultural classes has been questioned by very many.

We believe that in our farmers' clubs we have proven that organization is not only possible, but that it is of the utmost benefit. It would, indeed, be useless for me this evening to recount to you the advantages derived from clubs and club work. You are members of clubs and each know as well as I what a factor a club is in any agricultural community.

This question now presents itself for solution: How can we most effectually extend the influence of our organization? I can see no way which will prove so fruitful as the individual effort of local clubs. Each club should have one of its most earnest workers as a committee to organize new clubs. He should report progress at club meetings and every member should render him assistance whenever an opportunity presents itself. In this way the number of clubs will rapidly multiply and their influence become more general.

The officers of this association will be ever ready to aid in this work, but it is the local clubs that can ever do the most efficient service in this matter of the formation of new clubs.

It would seem that the County Association could not be otherwise than a power for good along the line of extending the effectiveness of club work. I am sure that in doing local work and in securing local reforms, a County Association would be of the greatest assistance. In my own county the County Association is as yet so young that we are hardly able to judge of its results, but much interest is being manifested, and we feel sure that it will not only be a permanent organization, but a very beneficial one as well. The subject of a county organization is an important one and its discussion will, I hope, come up at this meeting, that we may get the benefit of the experience of the delegates who have labored along this line.

Perfect unity of action is an absolute essential to the greatest influence. To have this we must be kept in the closest and most constant touch with one another. I am sure that I voice the sentiment of all present when I say that the Michigan Farmer is the agency which has rendered united effort on the part of the clubs possible. We should make constant use of this most valuable paper placed so freely at our service. I would advise that the very best talent in the club be employed as the Michigan Farmer correspondent, for it is by these monthly reports that the sentiment of the local clubs becomes known to all, and the outlining of a policy satisfactory to all becomes possible.

But it is to the editorials, the remarks and suggestions of the editor of this department, who sifts the thoughts of his correspondents and sounds the bugle call for action at just the opportune moment, and to the close thinking leaders of our organization who use this department that we receive the most benefit.

At the meeting of the directors in the summer it was decided to concentrate our united efforts on two measures, the Atkinson Equal Taxation Bill and the Kimmis County Salaries Bill. Prior to this year much good work has been done by the clubs in support of these two measures, but the opposition was too strong for us and our efforts were unavailing. I am rejoiced to observe that the results of the late elections are such as to give us great hopes of ultimate success. If these bills do become laws we will not claim all the glory. Other very influential agencies have been at work. We do claim, however, that the Farmers' Clubs have exerted a powerful influence, which has been felt throughout the State.

While our whole attention should be centered on these two measures and nothing be left undone that can be done to secure their right and equitable settlement, yet other measures will require our earnest vigilance and prompt action. Let us be wary and ready to act as a unit if occasion demands.

The public mind is much agitated over our present system of making nominations. It is a lamentable fact that in a majority of cases a few men make our nominations. There are men who make politics their business and in many instances they are men of low character and highly unscrupulous. Office seekers with a little of the necessary influence easily secure the coöperation of these political specialists. They sometimes form slates and pledge delegates even before the caucus is held. Thus candidates who are the choice of every small faction of the voters of their district get the nomination.

The importance of attending the primaries has long been felt and urged, but the evil is not abated. The political party too often becomes a machine, in the hands of the political specialist, and is too well manipulated. We all believe in thorough organization, yet it is because the parties are so well organized that this evil exists. We must not forget, however, that organization may become a power for evil as well as for good.

Thinking minds are casting about for a remedy from this evil which the bosses, through our present system, are enabled to fasten upon us. Different plans are proposed, among them one to make the primaries direct, giving the voters the privilege of voting directly for the candidate of their choice. I have nothing to recommend along this line except vigilance, but may the time soon come when the choice of candidates is as free from the dominating influence of the boss and the machine as the choice between candidates has already become through the adoption of the Australian ballot.

The retail liquor dealers, it is reported, are again ready to introduce a bill in our State Legislature allowing them to keep open on all holidays, except Christmas and Thanksgiving, and on election day after the polls are closed. The liquor traffic is the bane of our government—a hydra-headed monster. Let us see to it that the cords with which we have bound it are tightened, rather than loosened.

Let us freely discuss, as time will permit, matters that should, or are likely to come up in our legislative halls this winter. It is through our deliberations that a plan of action can be outlined and valuable assistance rendered by the clubs. Let us have it distinctly understood that we ask no special favors, but demand our just share of the advantages and privileges of government as well as of its burdens.

Above all, let us see to it that our objects are right and our demands just, that we may have the conscientious support of the fair-minded and, better far, the approval and support of an Overruling Providence.

The morning session on Wednesday was given up to twenty minute talks by the heads of the various State institutions, Pres. Angell of the University, Dr. Boone of the Normal, President Snyder of M. A. C., Supt. Church of the School for the Blind and Supt. St. John of the Industrial School taking part.

Wednesday afternoon was given up to the election of officers and the hearing of and acting upon the reports of the various committees. Officers were elected as follows: President, L. D. Watkins, Manchester; Vice-President, Mrs. D. M. Garner, Davisburg; Secretary, A. B. Cook, Owosso; Directors, C. S. Johnson, Vassar; Myron Crafts, Jackson.

The following resolutions were adopted:

DECLARATION OF PRINCIPLES.

LEGISLATIVE AFFAIRS—STATE.

"Believing in the principle of local control of local affairs as enunciated in a bill introduced in the last legislature, known as the Kimmis county Salaries bill,

"Resolved, That we reaffirm our declaration that all county officials be paid in full for their respective services by stated salaries fixed by the respective boards of supervisors, and that it be made a criminal offense for such officials to receive any fees or other perquisites in addition to their salaries. Further, that the fees collected in the county offices be readjusted on an equitable basis, and hereafter all such fees be turned into the county treasury and become part of the general fund.

"We indorse the principle of equal taxation as laid down in what is known as the Atkinson bill, and would also recommend the repeal of all special charters of corporations and the placing of their property under the general tax laws of the State."

STATE AFFAIRS.

The Committee on State Affiairs submitted the following, which were adopted:

"We recommend the continuance of the present system of contract labor in the penal and reformatory institutions of the State as the fairest and most effective yet proposed or tested.

"We indorse the present law for the taxation of mortgages, but consider its provisions as falling short of accomplishing what the law was designed to do. We would recommend that the legislature be requested to make such changes as are necessary to make it thoroughly effective.

"We recommend that what is known as the Torrens system for the registration of transfer of real estate be adopted in this State as a sure means of putting an end to litigation, and establishing the titles to real estate on a sound and stable foundation.

"We recommend the passage of a law allowing appeals from justice courts only where the judgments are for a sum of $150 or over. We believe that the adoption of such a measure would tend to cut down the work of our circuit courts very materially, and effect a great saving to taxpayers.

"We indorse the State Agricultural College, and recommend such aid as will tend to render it more efficient in its several departments. We would, therefore, call attention to the absolute necessity for the addition to its equipment of a woman's building, in order that this department may have such accommodations as are demanded by its importance, in order that the young women of the State may enjoy such privileges as are extended to young men."

NATIONAL AFFAIRS.

"We commend the action of the Secretary of Agriculture in placing our products in foreign markets, believing that this expansion of trade inures to the benefit of the farmer as well as the whole people.

"As the farmers, being the consumers, pay a large proportion of the revenue under the present protective system, we recommend such a tariff as will be to their benefit by stopping the unlawful importation of products, especially the classification, sorting and mixing of foreign wool.

"We recommend the establishment of postal savings banks.

"We believe that the time for general free rural mail delivery has come, and urge immediate action.

"We recommend that Congressman-elect Roberts of Utah be not allowed to take his seat in Congress.

"We condemn the action of the express companies in disloyally refusing to pay their part of the war burden, and indorse the opinion of our supreme court on this question.

"In view of the deplorable fact that our national income is not sufficient to meet the expenses of the government, we recommend that congress provide the way for the enactment of an income tax, and duly enact the same.

GENERAL RESOLUTIONS.

"Resolved, That the canteen system as it existed during our late war was a reproach to our civilization, and that it is the duty of all good citizens to labor that this great iniquity shall be removed.

"Resolved, That we decidedly oppose the repeal of any portion of the law requiring the closing of saloons on legal holidays."

CLUB EXTENSION.

We recommend: 1. That each club, adjacent to unorganized territory, appoint a committee of one to assist in the formation of new clubs, who shall furnish constitution and by-laws for the same.

2. That each county having a county organization appoint a committee of three from different parts of the county to see that clubs are organizel in the unorganized territory.

3. That programs and reports of club meetings be furnished to local papers for publication, and efforts be made to interest the local press in club work extension.

4. That there be no paid organizers in the interests of club extension.

5. That the Association Secretary furnish blank constitution and by-laws, and also a circular letter setting forth the benefits of organization, to all parties desiring them.

Wednesday evening was given up to a union meeting of the State Grange and Association of Clubs. This meeting was the largest and most enthusiastic ever held.

MICHIGAN STATE AGRICULTURAL SOCIETY.

REPORT OF THE TRANSACTIONS OF THE SOCIETY FOR THE YEAR 1898, AND PROCEEDINGS OF THE WINTER MEETING OF THE EXECUTIVE COMMITTEE, JANUARY, 1899.

OFFICERS FOR 1898.

President—WILLIAM BALL, Hamburg.
Vice-President—I. H. BUTTERFIELD, Lansing.
Treasurer—C. W. YOUNG, Paw Paw.
Secretary—H. S. FRALICK.
Society address, Grand Rapids.

EXECUTIVE COMMITTEE.

Term ending January, 1899.

Eugene Fifield	Bay City, Bay County.
L. G. Townsend	Ionia, Ionia County.
F. H. Latta	Battle Creek, Calhoun County.
A. H. Zenner	Detroit, Wayne County.
L. W. Barnes	Byron, Shiawassee County.
W. P. Custard	Mendon, St. Joseph County.
H. D. Cutting	Tecumseh, Lenawee County.
M. P. Anderson	Midland, Midland County.
C. E. Lockwood	Washington, Macomb County.
W. E. Boyden	Delhi Mills, Washtenaw County.

Term ending January, 1900.

E. W. Hardy	Howell, Livingston County.
Frank Maynard	Jackson, Jackson County.
F. L. Reed	Olivet, Eaton County.
N. J. Kelsey	Marshall, Calhoun County.
H. R. Dewey	Grand Blanc, Genesee County.
R. D. Graham	Grand Rapids, Kent County.
John Lessiter	Pontiac, Oakland County.
H. H. Hinds	Stanton, Montcalm County.
F. E. Skeels	Grand Rapids, Kent County.
M. J. Gard	Violinia, Cass County.

EX-PRESIDENTS.

W. L. Webber	East Saginaw, Saginaw County.
Geo. W. Phillips	Romeo, Macomb County.
Wm. Chamberlain	Three Oakes, Berrien County.
A. O. Hyde	Marshall, Calhoun County.
T. W. Palmer	Detroit, Wayne County.

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS COMMITTEE.

Eugene Fifield, I. H. Butterfield and Secretary.

TRANSPORTATION AND PROGRAM COMMITTEE.

The Business Committee.

RECEPTION COMMITTEE.

A. O. Hyde, Wm. Chamberlain.

FINANCE COMMITTEE.

M. P. Anderson, H. R. Dewey, C. E. Lockwood.

PREMIUM LIST COMMITTEE.

Eugene Fifield, H. R. Dewey, R. D. Graham, L. W. Barnes, John Lessiter, E. W. Hardy, F. E. Skeels.

COMMITTEE ON RULES.

I. H. Butterfield, W. P. Custard, F. H. Latta.

GENERAL SUPERINTENDENT.

Eugene Fifield.

CHIEF MARSHAL.

L. G. Townsend.

EXECUTIVE SUPERINTENDENTS.

Cattle—W. E. Boyden.
Horses, speed—Eugene Fifield.
Horses, Roadsters, Draft and Pony Classes—H. H. Hinds.
Sheep—John Lessiter.
Swine—L. W. Barnes.
Poultry—H. D. Cutting.
Dairy, Bees and Honey—M. J. Gard.
Farm and Garden Products—F. L. Reed.
Vehicles—H. R. Dewey.
Machinery—Frank Maynard.
Manufactured Goods—M. P. Anderson.
Art Hall—N. J. Kelsey.
Needle Work and Children's Work—Mrs. F. E. Skeels.
Miscellaneous and Special Exhibits, Except Specials on Fruits—Frank Maynard.
Horticulture—R. D. Graham.
Gates—W. P. Custard.
Police—E. W. Hardy.
Forage—C. E. Lockwood.
Agricultural Implements—F. H. Latta.
Booths and Privileges—F. E. Skeels.

REPORT OF THE INSPECTORS OF ELECTION FOR OFFICERS FOR 1899.

Grand Rapids, Mich., Sept. 29, 1898.

We, the undersigned, inspectors of election at the Michigan Agricultural Society held at the Fair Grounds on this date, hereby certify that the following was the result of the ballot:

Whole number of votes cast was forty-seven (47). Of which

I. H. Butterfield received forty-seven for president.
M. P. Anderson received forty-seven for vice-president.
C. W. Young received forty-seven for treasurer.
H. S. Fralick received forty-seven for secretary.

And each of the following gentlemen received votes as follows:

FOR MEMBER OF THE EXECUTIVE COMMITTEE FOR TWO YEARS.

E. Fifield, forty-seven votes.
E. W. Jones, forty-seven votes.
Dr. Chas. A. Waldron, forty-seven votes.
Wm. Ball, forty-seven votes.
L. J. Rindge, forty-seven votes.
W. P. Custard, forty-seven votes.
J. E. Rice, forty-seven votes.
W. E. Boyden, forty-seven votes.
L. W. Barnes, forty-seven votes.
John McKay, forty-seven votes.

ROBERT B. LOOMIS.
GEO. W. STUART.
Inspectors.

On receiving this report the president declared the above named persons elected to the respective offices.

THE FAIR OF 1898.

The annual fair of the Society was held at Grand Rapids September 26th to 30th.

The change of date from the first week of September to the last week proved advantageous to the fair. The weather was fine with the exception of a rain which fell on the morning of Friday, the 30th, which apparently reduced the attendance on that day.

The fair was a success financially and as an exhibition. The address of the retiring president and the reports of the several officers made at the winter meeting show the work for the year and the condition of the Society.

Proceedings of the executive committee at the winter meeting, 1899:

The annual meeting was called as provided in the constitution to meet at the Hudson House, Lansing, Monday January 9th, at 8 o'clock P. M. A quorum not being present the meeting was adjourned to meet at Sweet's Hotel, Grand Rapids, January 31, 1899, at 7:30 P. M.

Sweet's Hotel, Grand Rapids, Jan. 31, 1899.

The executive committee met as per adjournment. Called to order by the president. Roll called and the following members present: President, vice president, secretary, treasurer, and Messrs. Fifield, Barnes, Anderson, Boyden, Hardy, Reed, Maynard, Dewey, Lessiter, Hinds, Skeels and Gard.

President Ball delivered his address as follows:

PRESIDENT'S ADDRESS.

Gentlemen of the Executive Committee of the State Agricultural Society:

A year has passed since the last annual meeting of this committee, a year filled with events of great importance not only to our own country, but to the whole world. Geographical boundaries have been changed. The prowess of the American armies both by land and sea has been demonstrated. The flag of this nation with its glorious stars and stripes, emblems of enlightenment and humanity, is floating in every clime, and by every civilized nation it is treated with greater respect than ever before. The industries of our whole country are in a prosperous condition and still expanding. The murmurs of discontent and distress of the past few years are hushed. Confidence in all kinds of business has been restored. Capital is seeking investment, and the laborer willing to work no longer seeks in vain for employment. The prospects for the future are encouraging.

With these pleasant and satisfactory assurances I greet you. The Michigan State Agricultural Society is not an exception in the enjoyment of this long-looked-for prosperity. The fair of 1898 from every standpoint was a success. The exhibitions in all departments did credit to the exhibitors. The order maintained throughout the week was excellent. The money received was sufficient to pay the expenses of the year, with a surplus sufficient to adjust some outstanding indebtedness.

The Society is to be congratulated upon the fact that it is nearly out of debt. It has been well known that for six or eight years past the Society has been badly handicapped by a heavy debt; at times standing on the verge of bankruptcy and dissolution. After locating the fair permenently in Lansing it was found that the buildings and grounds were inadequate for the purpose of a state fair. The grounds had to be graded, buildings erected, and other improvements made. For these expenditures a heavy debt was contracted. The fair of 1892, on account of rain, was a lamentable failure financially. In 1893 the total indebtedness was about $25,000. No fair was held in 1893 on account of the Columbian Exposition held that year in Chicago. In 1894 a fair was held in Detroit; enough money was received to pay expenses, 30 per cent of the premiums of 1892, insurance, interest on debt, and a small amount of other indebtedness.

With this indebtedness upon the Society it came to Grand Rapids. Its fairs have met with varying success; the first year paying expenses and a little more. The second fair did not pay out, and a call on the guarantee fund was made amounting to nearly $2,000. The third fair paid expenses. The fair of 1898 paid expenses and had a surplus as before stated. Within the past two years, by agreement between the Society and its heaviest creditors (three banks in Lansing), the Society amicably adjusted those debts by deeding to said banks all its right and title in the grounds occupied while holding fairs in the city of Lansing. Other debts have been liquidated as fast as possible, and as said before the Society is nearly out of debt, with a bright prospect before it for future usefulness.

This in brief is the present and past situation financially of the Society since 1892. These results have not been obtained by accident, but by business men of experience determined to succeed even in the period of the greatest financial distress this country has exprienced since 1837. The success of this Society with its heavy indebtedness, without outside aid, together with the unusual conditions which ruined so many industries, is without a parallel in the management of state fairs in this country. The exhibitions of the Society have always been of a high order. As a stimulus and an educator fairs and expositions are a necessity. How they should be managed to bring out the best efforts of the husbandman, the manufacturer, the artist and the student, and at the same time secure the means necessary for their existence without aid is a serious question and one that will tax the best judgment of those upon whom these duties fall. The responsibility resting upon those who manage fair matters are two-fold. Fairs or exhibitions must be made self-sustaining and at the same time be so conducted as to receive the commendations of all good citizens. So many sources of amusement and pleasure exist that attractions of general interest must be secured in order that people shall be induced to attend fairs in large numbers in order that they may be made self-sustaining. People differ in their desires and are interested in different directions. As far as possible these different interests should be secured if of an instructive character and not harmful to any. Premiums should be offered sufficient in amount to bring out the best productions of the farm, the manufacturer, etc. I am of the opinion that the premium list of this Society should be carefully revised and as soon as circumstances will warrant increased. In the interests of economy last year the premiums were reduced. It was a question of policy owing to indebtedness. Does the same need prevail now? Economy is necessary to success. Parsimony will ruin many undertakings.

The future prospects of this Society if well managed are brighter than they have been in the last decade. Business is better, people are paying debts and have more money to spend.

Farmers are becoming more interested in the improvements in the domestic animals, in manufactured goods of all kinds, and they know that the benefits secured by examination of these different productions when brought together at fairs cannot be obtained so cheaply and beneficially in any other way. Not only farmers, but those engaged in other pursuits are equally benefited by fair exhibitions. Street fairs and carnivals have for a year or two been hindrances in the way of attendance. The signs of the times point towards their non-existence in the near future. Business people in cities and towns soon tire of putting up money to secure attractions for the farmers and others to gaze upon free, when they fail to be remunerated by increased trade and profits.

A few words of a personal nature and I am done. For six years I have tried as well as I know how to discharge the duties of this Society. In what manner I have succeeded in filling the position you know better than I. So far as I know, our relations have been pleasant and friendly. I have not language to sufficiently express the gratitude I feel towards every loyal member of this Board for their uniform kindness and forbearance to me through these past six years.

The recollection of them will cheer me during the few remaining days allotted me here. I am still with you and a worker in the interests of the Society. To my successor I offer my best wishes. May his success be great. I hope, and in fact I know, that the same good will and hearty support will be extended to him that have been given to me.

The secretary reported as follows:

Gentlemen of the Executive Committee:

The receipts of my office for the year have been as follows:

Membership certificates	$360 00
Stall rents	256 90
From J. H. Steiner fines	6 50
	$623 40

for which I hold the receipts of the treasurer.

The total amount of premiums awarded and paid for 1898 is $7,166.75. The number of entries in each class and division were as follows, with the amounts awarded:

Division A—Cattle.

Class.		No. of entries.		Amount of premiums awarded.	
1.	Shorthorns	60		$272 00	
2.	Devons	28		247 00	
3.	Herefords	44		277 00	
4.	Jerseys	95		278 00	
5.	Galloways	39		267 00	
6.	Aberdeen Angus	33		210 00	
7.	Holstein Friesian	13		150 00	
8.	Red Polled	39		203 00	
9.	Fat cattle	20		121 00	
10.	Sweepstakes for milk	4		9 00	
		——	375	———	$2,034 00

Division B—Horses.

11.	Standard Bred	57		$232 00	
12.	Roadsters—not standard	25		97 00	
13.	Carriage and buggy horses	28		111 00	
14.	Saddle horses	2		18 00	
15.	Horses for all work	34		159 00	
16.	Cleveland Bays	5		25 00	
17.	French Coach	3		14 00	
18.	Hackneys	..		......	
19.	Percheron or French Draft	30		181 00	
20.	Clydesdale or English shire	10		91 00	
21.	Grade Draft	15		102 00	
22.	Shetland Ponies	10		———	$1,030 00
		— —	219; 13 diplomas.		

Division C—Sheep.

23.	American Merinos	43		$163 00	
24.	Rambouillet Merinos	35		126 00	
25.	Delaine Merinos	34		100 00	
26.	Lincolns and specials	57		169 00	
27.	Leicesters	50		114 00	
28.	Cotswolds	25		124 00	
29.	Shropshire	84		161 00	
30.	Hamsphires	27		142 00	
31.	Oxfords	20		58 00	
32.	Southdowns	5		......	
33.	Fat sheep, ...5 diplomas	16		42 00	
		——	396	———	$1,199 00

Division D—Swine.

34.	Berkshire and specials	40		$126 00	
35.	Essex	53		132 00	
36.	Suffolk and Yorkshire	41		114 00	
37.	Poland China and specials	92		132 00	
38.	Duroc Jerseys	18		68 00	
39.	Chester Whites	60		132 00	
40.	Victorias	34		115 00	
		——	338	———	$819 00

Division E—Poultry.

41.	Total entries		889		303 00

Division F—Grain and Vegetables.

42.	Grain and seeds	167		$80 00	
43.	Roots and Vegetables	280		101 50	
44.	Professional display	3		50 00	
45.	Flour, meal and feed	4		10 00	
46.	County institute societies	..		2 00	
		——	454	———	241 50

Division G—Dairy Products.

47.	Butter and cheese	14		$16 00	
48.	Sugar, bread and pickles	48		34 00	
49.	Dried, canned and preserved fruits	42		90 00	
50.	Soap and toilet articles	..		......	
		——	104	———	140 00

Division H—Bees and Honey.

51.	Total		34	$117 00	
				———	117 00

Division I—Farm Implements.

52.	Total entries for premiums		12		
	No premiums awarded in this class.				No awards.
	There were a large number of displays for exhibition only.				

Division J—Vehicles.

53.	Total entries		34		11 Diplomas,
	A large number of displays for exhibition only.				A Silver Cup.

Division L—Manufactures.

54.	Wool in fleece		3	$10 00	
55.	Leather	All for display only			
56.	Furniture				
57.	Iron works				
58.	Clocks and Jewelry				
			——	———	$10 00

Division M—Musical Instruments.

58.	Total entries		58		

Division N—Art Work.

59.	Paintings, professional or amateur	25		$155 00	
	Frames	2		....	
	Photographs	8		....	
	Painting professional artists	126		266 50	
60.	Painting and drawing amateur	114		71 75	
61.	Industrial art	53		50 00	
		——	328	———	543 75 and 12 Diplomas.

Division O—Needlework.

62.	By dealers, professional artists	175		$89 00	
63.	By amateurs	184		38 50	
64.	By professionals or amateurs	31		12 00	
65.	Crochet or knit work	114		27 00	
66.	Children's department	40		15 75	
			544		$182 25

Division P—Fruits and Flowers.

67.	Artistic exhibition of horticultural products	4		$38 00	
68.	General collection, fruits for family use	7		60 00	
69.	General collection, market fruits	8		37 00	
70.	Special exhibit of peaches	10		35 00	
71.	Special exhibit of pears	10		36 00	
72.	Special exhibit of plums	10		17 00	
73.	Special exhibit of grapes	13		30 00	
74.	Single plates of fruit—				
	Apples	469		120 00	
	Pears	138			
	Peaches	88			
	Plums	125			
	Grapes	78			
	Quinces	15			
	Cranberries	3			
75.	Plants and flowers in beds	4		60 00	
76.	Plants in pots	56		169 00	
77.	Cut flowers and floral designs	20		45 00	
			1,058		647 00

Division R—Miscellaneous.

78.	Total entries		5	No money awards.
	Department of specials	300	300	$1,000 00
	Total entries in all departments where premiums are offered		5,151	

Total premiums regular	$7,341 50
Total premiums, special value	1,000 00
Total premiums, speed	2,222 50
Grand total	$10,564 00

Diplomas	45
Silver cup	1

H. S. FRALICK, Secretary.

Report of the Treasurer.

Gentlemen—I have the pleasure of submitting the following as my report for the year 1898:

RECEIPTS.

Cash on hand January 11, 1898		$210 94
July 1, 1898, borrowed		500 00
Receipts from fair—		
Adult admission	$9,507 40	
Half admissions	496 25	
Children's admissions	405 00	
Soldiers' Home	98 25	
Masonic Home	1 50	
Railroad coupon tickets	4,202 62	
		14,711 02

Grand stand	$1,698 50
Privileges	2,306 89
Speed	1,395 00
From secretary	623 40
Membership	81 00
Superintendent of police, collections	1 42
Walker refunded	1 00
	$21.529 17

DISBURSEMENTS.

Business orders paid		$8,874 81	
Speed premium orders paid		2,250 00	
Premium orders paid		7,166 75	
		$18.291 56	
Paid in settlement 1892 premiums	$1,428 07		
Attorney fees and damages	177 00		
On indebtedness	1.500 00		
		3,105 07	21,396 63
Balance on hand			$132 54

All of which is respectfully submitted,

C. W. YOUNG,
Treasurer.

The business committee submitted its report as follows: Your committee reports business transactions in detail.

Business Committee Expenses.

1898.	No. of order.	Classification.	Amount.	
Jan. 12	3	H. S. Fralick, Secy., personal expenses	$2 40	
June 7	19	H. S. Fralick, Secy., personal expenses	8 00	
Sept. 30	59	Eugene Fifield, personal expenses	78 52	
" 30	71	I. H. Butterfield, personal expenses	55 50	
Aug. 30	72	I. H. Butterfield, personal expenses	4 44	
Oct. 12	109	H. S. Fralick, Secy., personal expenses	2 70	
" 14	114	I. H. Butterfield, personal expenses	7 66	
" 14	115	Eugene Fifield, personal expenses	9 48	
1899.				
Jan. 28	133	H. S. Fralick, Secy., personal expenses	12 40	
				$181 10

Executive Committee.

Jan. 12	1	H. D. Cutting, expense winter meeting	$12 95
	2	N. J. Kelsey, expense winter meeting	5 68
	4	Frank Maynard, expense winter meeting	8 70
	5	M. J. Gard, expense winter meeting	9 62
	6	L. W. Barnes, expense winter meeting	10 27
	7	C. E. Lockwood, expense winter meeting	4 42
	9	E. W. Hardy, expense winter meeting	9 85
	10	H. R. Dewey, expense winter meeting	11 87
	11	W. P. Custard, expense winter meeting	4 90
	12	R. D. Graham, expense winter meeting	3 40
	13	A. H. Zenner, expense winter meeting	11 25
Sept. 30	39	W. P. Custard, personal expenses	21 55
	41	N. J. Kelsey, personal expenses	14 54
	42	H. D. Cutting, personal expenses	35 29
	43	G. H. True, personal expenses	20 23
	45	L. W. Barnes, personal expenses	24 15
	47	F. L. Reed, personal expenses	35 59
	49	W. E. Boyden, personal expenses	59 21
	53	John Lessiter, personal expenses	38 25

		55	H. R. Dewey, personal expenses	$50 16	
		57	W. P. Custard, personal expenses	3 80	
Oct.	1	58	Frank Maynard, personal expenses	29 02	
		63	M. P. Anderson, personal expenses	27 57	
		68	E. W. Hardy, personal expenses	25 95	
		81	F. E. Skeels, personal expenses	59 16	
		99	H. H. Hinds, personal expenses	12 95	
					$550 33

President's Office.

Jan.	12	8	Wm. Ball, expense winter meeting	$10 55	
Oct.	1	61	Wm. Ball, personal expenses	74 67	
					85 22

Secretary's Office.

Mar.	14	14	H. S. Fralick, express and postage	$5 97	
Apr.	19	16	H. S Fralick, postal cards	10 00	
May	9	18	H. S. Fralick, postage and express	10 00	
June	7	20	H. S. Fralick, postage, express and freight	12 00	
"	7	21	H. S. Fralick, on account salary	100 00	
July	11	23	H. S. Fralick, express and telegrams	5 00	
"	11	24	H. S. Fralick, postage on premium lists	60 00	
Aug.	15	25	H. S. Fralick, postage on mailing tubes	20 00	
"	15	26	H. S. Fralick, express, telegraph and freight	10 00	
Oct.	12	110	H. S. Fralick, express and postage	21 45	
"	14	118	H. S. Fralick, balance of salary	475 00	
"	14	122	H. S. Fralick, messenger boy, desk, etc	14 25	
Nov.	2	127	H. S. Fralick to Lille C. Holland, type writing	3 45	
Dec.	17	129	H. S. Fralick, express and postage	8 88	
					756 00

Treasurer's Office.

Oct.	15	123	C. W. Young, treasurer, personal expenses.	$69 94	
"	14	119	C. W. Young, salary	200 00	
"	14	121	C. W. Young, pay roll office	125 14	
					395 08

Printing and Stationery.

Sept.	30	73	C. & J. Gregory, printing tickets	$24 75	
Oct.	1	87	Powers-Tyson Ptg. Co., printing	264 58	
"	1	89	Fair Pub. House, printing	28 50	
"	14	113	Will N. Hine, stationery	6 98	
					324 81

Judges.

Sept.	28	32	S. Butterfield, judge poultry	$25 00	
"	29	34	Frank H. Johnson, judge cattle	27 00	
"	30	36	Geo. W. Stuart, judge election	4 00	
"	30	37	E. A. Turner, judge art department	20 00	
"	30	43	A. H. Barber, judge dairy	6 65	
"	30	46	A. A. Wood, judge swine	13 84	
"	30	48	H. M. Strong, judge agricultural department	16 50	
"	30	52	John Lessiter, paid judge sheep department	18 50	
"	30	56	D. P. Dewey, judge vehicle department	12 63	
Oct.	1	58	F. Maynard, paid cattle department	7 00	
Sept.	30	62	R. D. Graham, paid judges horticultural department	44 15	
Oct.	1	80	Mrs. F. E. Skeels, paid judges needlework.	23 65	
"	1	84	H. R. Dewey, farm implements	8 00	
"	4	102	F. E. Skeels, paid judge needlework	15 14	
Sept.	29	107	Mesdames Estabrook & Grant	3 00	
Oct.	5	108	Will Clark, art department	8 75	
					253 81

Advertising.

Apr.	23	17	C. B. Crisp, putting up banner............	$9 50	
Aug.	31	28	Eli Bidleman, advertising and distributing	21 42	
Sept.	30	42	H. D. Cutting, paid bill poster............	10 00	
"	27	44	Eli Bidleman, advertising and distributing	35 56	
"	30	66	Grand Rapids Herald, advt................	50 00	
"	30	67	D. Schram, advertising..................	16 80	
Oct.	1	75	Woodman committee advertising.........	5 00	
"	1	82	Grand Rapids Democrat, advt.............	50 00	
"	1	83	Geo. M. Leonard, bill posting.............	71 55	
"	1	85	The Times, advt.........................	10 00	
Sept.	30	86	I. H. Butterfield, paid advertising........	24 85	
Oct.	1	87	Powers-Tyson Ptg. Co., advertising	186 45	
"	1	89	The Fair Pub. House, advertising.........	12 00	
"	1	93	H. S. Fralick, secretary, bills paid........	48 44	
"	1	91	Evening Press Co., advertising...........	42 00	
"	1	96	Int. Advt. Co., book marks................	186 75	
"	1	97	Chas. A. Coye, banner....................	28 00	
"	1	98	H. S. Fralick, secretary, paid bill posters.	80 00	
"	4	100	W. J. Mulford, street car banners.........	10 00	
"	14	103	Eugene Fifield, paid advertising...........	10 30	
Sept.	30	104	Geo. M. Savage, advertising..............	138 50	
Oct.	14	106	H. S. Fralick, secretary, paid bills........	73 38	
Nov.	2	127	H. S. Fralick, secretary, paid bills........	12 75	
Dec.	17	128	H. S. Fralick, secretary, paid bills........	35 50	
Oct.	12	109	H. S. Fralick, secretary, paid bills........	29 71	
"	14	114	I. H. Butterfield, paid banner ad.........	2 50	
					$1,200 96

Music.

Oct.	1	65	Frank Wurzburg, band..................	$210 00	
					210 00

Badges.

Aug.	23	76	The Whitehead-Hoag Co..................	$15 65	
Oct.	1	92	Enterprise Ptg. Co., horse badges.........	7 00	
					22 65

Gate Department.

Sept.	30	35	Pay roll gate keepers.....	$218 47	
					218 47

Police.

Sept.	30	69	Pay roll, police........	$473 41	
					473 41

Booths and Privileges.

Sept.	30	77	Pay roll.................................	$183 34	
					183 34

Buildings and Grounds.

Oct.	1	50	West Michigan Society, rent..............	$1,000 00	
"	1	94	Voight, Herpolsheimer & Co., decorating	97 88	
"	1	95	Spring & Co., cloth for tables.............	36 23	
"	4	101	F. E. Skeels paid labor...................	43 40	
"	14	116	West Michigan Society, supplies..........	24 41	
Sept.	30	88	Chas. A. Coye, rent of tents..............	244 00	
					1,445 92

Speed Department.

Aug.	19	27	American Trotting Assn. membership.....	$28 50	
Sept.	27	29	E. Fifield, supt., purses paid..............	1,050 00	
"	28	33	E. Fifield, supt., purses paid..............	600 00	
Oct.	1	51	Geo. S. Ward, clerk speed department....	96 83	
Sept.	30	60	E. Fifield, supt. expenses..................	28 24	
Oct.	1	64	E. M. Sharp, marshal expenses...........	32 98	

Oct.	1[illegible]	70	W. F. Adams, starting judge	$34 00	
"	15	124	John Carmody, securing entries	25 00	
Sept.	30	38	E. Fifield, purses paid	600 00	
					$2,505 55

Premiums.

Apr.	19	15	H. S. Fralick, secy, to pay premiums of 1897	$20 00	
Oct.	14	120	C. W. Young, treas., to pay premiums of 1898	7,139 75	
					7,159 75
1899.					
Jan.	31	134	C. W. Young, treas., to pay premiums of 1898	$7 00	7 00
					$7,166 75

General Expenses.

June	7	22	J. E. Rice to pay claim	$27 00	
Sept.	28	30	Thos. F. McGarry, legal services	150 00	
"	28	31	S. M. Lemon, U. S. license	8 33	
Oct.	1	54	Geo. S. Ward, to pay special attraction	1,000 00	
"	1	74	John Kuffler filling tank	12 00	
"	1	78	Modern Woodmen, per centage	200 00	
"	1	79	Dorr Skeels, surveying	21 00	
"	1	90	Old National Bank, note and interest	511 67	
"	1	92	H. S. Fralick, secy., to pay sundry bills	12 82	
"	14	105	H. D. Plumb, hay and straw	176 70	
"	"	112	H. S. Fralick secy., to pay sundry bills	19 45	
"	"	113	H. S. Fralick secy., " " " "	61 67	
"	"	117	Peter Tierney, rebate, untrotted race	23 32	
"	15	125	West Michigan Society, per centage on receipts	300 00	
"	"	126	Eugene Fifield, to pay on society notes	1,500 00	
"	17	130	H. S. Fralick, secy., Diploma and tubes	15 25	
Mar.	14	14	H. S. Fralick, secy., " " " 1897	15 90	
1899					
Jan.	28	133	H. S. Fralick, secy., for writing Diplomas	5 00	
"	"	131	R. E. Brackett, silver cup for premium	16 00	
"	"	132	H. S. Fralick, secy., sundry bills	12 85	
"	31	135	C. W. Young, treas., to pay balance on premiums, 1892	1,428 07	
Feb.	1	136	F. L. Rogers, legal services	15 00	
"	1	137	Harry Hollis, care of horse and expenses	25 00	
					5,557 03

SUMMARY.

Business Committee	$181 10	
Executive Committee	550 33	
President's Office	85 22	
Secretary's Office	756 00	
Treasurer's Office	395 08	
Judges	253 81	
Printing and stationery	324 81	
Advertising	1,200 96	
Music	210 00	
Badges	22 65	
Gate Dept	218 47	
Police department	473 41	
Booths and Privileges	183 34	
Buildings and grounds	1,445 92	
Speed department	2,505 55	
Premiums	7,166 75	
General Expense	5,557 03	21,530 43

Your committee also reports that an offer was made to the premium holders of the Fair of 1892 to pay to them fifty per cent of the balance due on said premiums, provided this amount would be accepted in full payment. This offer has been accepted by all but nine of the holders, and the amount has been paid to those who accepted. Also the sum of $1,500 has been paid on society notes, leaving a balance due of $1,000 and interest.

EUGENE FIFIELD,
I. H. BUTTERFIELD,
H. S. FRALICK,
Business Committee.

On motion the reports of the secretary, business committee and treasurer were referred to the finance committee.

The president appointed F. E. Skeels member of the finance committee, to act in place of C. E. Lockwood, not present.

The president presented the following:

RESIGNATION OF MR. KELSEY.

Lansing, Jan. 28, 1899.

To the officers and members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—Believing the interests of our Society could be best secured by members on the executive board who are physically strong and active, and owing to my present relation to all work requiring me to be on my feet, I would respectfully tender my resignation as member of the executive committee, said resignation to take effect the 31st inst.

Be assured the kindness and forbearance accorded me by my associates on the official board through all the years of my connection with the State fair will never be forgotten, nor will my withdrawal lessen in the least my interest in the future success of the Society.

Very respectfully,
N. J. KELSEY.

The resignation was accepted.

On motion of Mr. Butterfield the secretary was directed to tender the thanks of the executive committee to Mr. Kelsey for his long and faithful service to the Society and regret at his decision to leave its service.

REPORTS OF SUPERINTENDENTS.

DIVISION A—CATTLE, FRANK MAYNARD, SUPERINTENDENT.

The exhibition of cattle at the last State fair was unusually good both in numbers and quality.

Total number of entries in Division A were 375. Total amount of premiums offered, $2,437.00; total amount of premiums awarded, $2,044.00.

A number of new exhibitors appeared, while a goodly number of the old ones came again.

In class 2, Devons, two herds were exhibited, both from outside the State. If Michigan farmers are not breeding Devons they must lack in merits. Would advise cutting the premiums offered in this class, and putting them on some of the more popular breeds.

Would also suggest making the herds premium much larger, and charge a percentage entry fee. Diplomas for the sweepstakes gave good satisfaction and are worthy of a further trial.

FRANK MAYNARD,
Superintendent.

DIVISION B—HORSES.

As acting superintendent of Division B I beg to report as follows:

Total number of entries, 219. Amount of premiums offered, $2,117. Amount awarded, $1,030. The show in this department was much better than the two years previous. So far as I know, this department ran along fairly well, and I think the awards were well made. Some of the rules in this department should be more closely drawn, in my opinion.

All of which is respectfully submitted.

W. E. BOYDEN,
Superintendent.

DIVISION C—SHEEP.

As superintendent of sheep, I report as follows:

The number of sheep on exhibition was 396. Amount of premiums awarded, $825. The quality of the exhibit was good. Shropshires still lead in number. There is apparently a renewed interest in the merino classes, which formerly were the leading breeds in this State.

JOHN LESSITER,
Superintendent.

DIVISION D—SWINE, L. W. BARNES, SUPERINTENDENT.

As superintendent of Division D I respectfully submit the following report:

Total number of entries	338
Total amount of premiums offered	$924
Total amount of premiums won	833

The exhibit of swine was very good in point of numbers shown—not quite up to some of our late fairs, still it was a big show.

The quality was decidedly good in some classes, notably that of Poland-Chinas, in which there was strong competition.

Everything passed off smoothly, and I think exhibitors were well satisfied. I wish to recommend one or two changes or additions in the rules, at the proper time.

Very respectfully,
L. W. BARNES.
Superintendent.

DIVISION E—POULTRY.

The total number of entries in this department was	889
The total amount of premiums offered	$516
The total amount of premiums won	303

H. D. CUTTING,
Superintendent.

DIVISION F—FARM AND GARDEN PRODUCTS.

The exhibition in Division F, at the last fair, was equal to any of the late exhibits in this division.

The number of entries, 454, and amount of premiums awarded, $241.50.

The number and excellence of the samples of grain and of potatoes were never better. The exhibit of the Agricultural College was a departure from the usual line, and was looked upon by some as a small showing for so large plant, and by others as a very interesting and instructive exhibit.

I should hope for a much larger exhibit from the College in the same line the coming year. The Canadian exhibit of grains and grasses was large and fine, and brought out many favorable comments from visitors.

F. L. REED,
Superintendent.

DIVISION G—DAIRY AND OTHER PRODUCTS.

With reference to this department, a complete revision of the list is needed. I would suggest that about $200 in cash premiums be offered for butter and cheese, something as follows:

Creamery butter	$75
Dairy butter	20
Print butter	15
Cheddar cheese	40
Michigan cheese	40
Best case brick	5
Best Swiss	5
Best display fancy cheese, five varieties	10

Premiums in the department, unless otherwise noted, to be awarded on the pro rata plan; 90 points being the minimum score for all awards on creamery butter and cheese, and 88 points the minimum for dairy butter. The premiums to be divided among the butter and cheese scoring above the stated minimum, on the following basis:

Creamery butter and cheese scoring over 90 to be entitled to one share for every point over 90, and two shares for each point scored above 95. Dairy butter scoring over 88 points to be entitled to one share pro rata for each point scored over 88 up to and including 93.

Provided that the maximum amount awarded to any one exhibitor of creamery butter shall not exceed $12, and the maximum for dairy butter shall not exceed $8, and for print butter $5. The maximum premium for Cheddar or Michigan cheese shall be $12.

Following this plan you see only good goods receive premiums and all of merit get something. If the exhibit is small the money offered is not all paid out.

I would suggest further that if anything like the above list of premiums be offered, a different place for exhibiting dairy products will have to be provided.

With reference to the bee business I have no suggestions to offer.

With reference to the canned fruit and bread department I would suggest a revision of the list so that it would include products of the culinary art beside bread. The canned fruit list, I think, needs revision. Perhaps a new department should be formed, to be called the culinary department.

G. H. TRUE,
Assistant Superintendent.

DIVISION I—FARM IMPLEMENTS. H. R. DEWEY, SUPERINTENDENT.

I beg leave to report that the exhibit in Division I was a grand success, both as to amount of goods on exhibition and the taste displayed in arranging the same. The determination of exhibitors to make their department superior to any for many previous years was plainly visible, as the result showed that they spared neither work nor expense to accomplish this most satisfactory result.

Every foot of space was taken and a great demand for more room was made. There was a general feeling of good fellowship expressed to the superintendent in charge by exhibitors, who claimed that they had accomplished more than they had hoped, and were well pleased with the result. The success in this department was equally due to exhibitors who gave their support to sustain the rules of the Society. I would recommend that there be some other than the "button route."

Very respectfully submitted,
H. R. DEWEY,
Superintendent.

DIVISION J—VEHICLES.

I would report that the exhibit in Division J was very creditable for both exhibitors and Society. The space reserved for this department was well filled with fine goods, making a display very attractive to both customer and sightseer.

With one exception, so far as I was able to learn, there was a feeling of general satisfaction; and I beg leave to thank exhibitors for their generous support and loyalty in their efforts to make the vehicle department second to none.

I would make the recommendation as before that the "button route" be changed, if possible. I would also recommend that the business committee arrange for and furnish complete the covering and protection for goods in this department.

H. R. DEWEY.
Superintendent.

DIVISION K—MACHINERY.

The exhibit in this department was very light and was turned over to Mr. Dewey.

FRANK MAYNARD,
Superintendent.

DIVISION N.—ART DEPARTMENT.

By an arrangement entered into between your superintendent and F. E. Skeels, the latter kindly attended to the alloting of space to exhibitors, and looked after other details in connection with the hall, for which I desire to thank him. All arrangements for space were satisfactory so far as I know, and everything worked harmoniously. Aside from Mr. Skeels' assistance I feel indebted to Mr. M. B. Anderson for assistance rendered during the fair.

Respectfully submitted,
N. J. KELSEY,
Superintendent.

DIVISION O—NEEDLE AND FANCY WORK, MRS. F. E. SKEELS, SUPERINTENDENT.

I would respectfully submit the following report:

The revision of the premium list by your committee resulted in the forming of two departments—one for dealers, professionals, and art teachers, and one for amateurs. This division was a decided improvement over the old plan and resulted in bringing out a much larger and more attractive display than usual, and is an arrangement which we would suggest as a good plan to follow in the future.

We would also point out the fact that the placing of the display upon the walls instead of tables is a good plan to follow and prevents the handling of the delicate fabrics usually shown. Until the Society can afford to show these finer articles in glass, we would recommend this course as the best to follow. The following were the entries:

In class 62, by dealers, professional artists, and art teachers	175 entries.
In class 63, by amateurs	184 entries.
In class 64, by professionals or amateurs	31 entries.
In class 65, by crochet or knit work	114 entries.
In class 66, children's department	40 entries.
Total entries	544

Premiums offered in class 62,	$107.50; premiums awarded...	$89 00
Premiums offered in class 63,	70.25; premiums awarded...	38 50
Premiums offered in class 64,	17.50; premiums awarded...	12 00
Premiums offered in class 65,	28.50; premiums awarded...	27 00
Premiums offered in class 66,	32.75; premiums awarded...	15 75
Total offered		$256 50
Total awarded		182 25

Sincerely,
MRS. F. E. SKEELS,
Superintendent.

MISCELLANEOUS AND SPECIALS.

The total number of entries in class 68 were 5; and in class 69, ——. I have no suggestions to make for this department.

The special exhibit was never finer than at the fair of 1898, and will warrant the continuance of this department, which has proved so instructive and entertaining.

The total number of entries for specials was 300. The premiums for the school specials should be enlarged so all the grades can compete.

FRANK MAYNARD,
Superintendent.

No report was received from the superintendent of horticultural department. The exhibit was, however, unusually fine.

H. S. FRALICK,
Secretary.

SUPERINTENDENT OF GATES.

I submit the following report:

I employed 14 men to tend gates, at a cost of $2.50 per day each and railroad fare one way; they to pay their own board bill; making a total cost of $198.47. Hired four men to tend grand stand at $1.00 per day each—total $20.00. Grand total, $218.47. The cost of tending gates was more than in 1897 owing to one more gate, which took three more men.

Respectfully,
W. P. CUSTARD,
Superintendent.

SUPERINTENDENT OF POLICE.

I beg leave to make the following report:

Total number names on pay roll during the State fair, 48; total expense to the Society, $473.41.

Again I wish to express my appreciation of the assistance given me and active interest taken, in ridding the grounds of unwelcome visitors, by Chief of Police Carr and his men, also by Sheriff Woodworth, of Grand Rapids.

Respectfully submitted,
E. W. HARDY.

BOOTHS AND PRIVILEGES.

I desire to submit my report as follows:

Received from grand stand concessions	$849 20
Received from shows	250 63
Received from main dining hall	120 96
Received from merry-go-round (33 1-3 per cent)	28 63
Received from check rooms	51 85
Received from carry all	50 00
Received from labor and lumber	9 78
Received from small concessions	945 84
Total	$2,306 89

I believe the success of the department for the year was dependent in a great measure upon the new system adopted of requiring each renter to pay in advance before allowing them to occupy any space upon the grounds, the result being fewer concessions, and consequently fewer passes for proprietors and help, and much better business for those who pay for space. This plan is also well received by the privilege people themselves. The Society should have full control of every building upon the grounds occupied for the fair, during the exhibition. The experiment of taking care of the check rooms by our own help rather than by commission doubled our receipts from that source, after paying all expenses.

Respectfully submitted,
F. E. SKEELS,
Superintendent.

The reports of the executive superintendents were referred to the committee on premium list and the committee on rules, to be appointed.

The finance committee reported as follows:

REPORT OF FINANCE COMMITTEE.

To the President and Executive Committee Michigan State Agricultural Society:

Gentlemen—We, your committee on finance, to whom was referred the report of the secretary, business committee and the treasurer, beg leave to make the following statement: We have made a careful examination of all vouchers, stubs and books by checking and comparing, and find the reports as rendered correct.

All of which is respectfully submitted.

M. P. ANDERSON,
H. R. DEWEY,
F. E. SKEELS,
Committee.

The report was accepted and adopted.

On motion adjourned sine die.

The officers and executive committee elect for 1899 were called to order by the president. Roll called and the following members were found present: President I. H. Butterfield, Vice President M. P. Anderson, Secretary H. S. Fralick, Treasurer C. W. Young, and the following members of the executive committee: Eugene Fifield, Frank Maynard, F. L. Reed, E. W. Hardy, H. R. Dewey, John Lessiter, H. H. Hinds, F. E. Skeels, M. J. Gard, L. W. Barnes, William Ball, W. E. Boyden, Eugene W. Jones, J. E. Rice, C. A. Waldron, L. J. Rindge, John McKay.

The president elect presented his address:

ADDRESS OF PRESIDENT ELECT I. H. BUTTERFIELD.

Gentlemen of the Executive Committee of the Michigan State Agricultural Society:

The Michigan State Agricultural Society has been in existence just fifty years. It has behind it half a century of usefulness to the agricultural industries of the State. In its earlier history it was the chief stimulus to improvement in agriculture and to the introduction of improved breeds of live stock into Michigan.

The annual fairs were the occasion of the gathering together of the best farmers of the State with their families, and the commingling with the business men and manufacturers, as well as professional men; for in its early as well as later years, it has had active members from all classes and professions. The Governor of the State was its first president and it has numbered since as incumbents of that office, men who have taken prominent part in public affairs. Its officers have invariably been men of high character and standing in the communities in which they resided. At this period in its career, it seems fitting to review in brief its past history.

ORGANIZATION.

Organized in February, 1849, at Lansing, by the State officers and members of the legislature. Governor Ransom was made its first president and the first fair held at Detroit in September of that year. The premiums awarded amounted to $808.50 and the other expenses of this first fair were for buildings and rent, $1,114.66, other expenses, $736.70. Total receipts including $400 from the State and $523 from the citizens of Detroit, $3,923.91. At the close of the year a balance on hand of $1,264.05.

From its organization the society held a prominent place in developing the industries of the State. Being a mutual organization with no permanent endowment, it became at times financially embarrassed, but its officers were men filled with public spirit and great generosity and self sacrifice, and carried it safely over to times of prosperity.

It is needless at this time to recount all the benefits that the State has received from this organization, but among others, it was one of the chief factors in securing the establishment of the State Agricultural College and lent its influence to securing the appropriation for the United States Experiment Stations made by Congress.

It has disbursed for premiums, in round numbers, $400,000. It is not necessary to review its struggles of a few years past, under a burden of debt, during which time it has continued to hold successful fairs and is now nearly free from embarrassment.

As the fair of 1899 will be the fiftieth annual fair, I recommend that steps be taken to properly commemorate the semi-centennial year of its existence in an appropriate manner at the annual fair. I have now no suggestions as to details, but leave the matter in your hands.

As a society, however, while we may "point with pride" to its past record, it cannot live on that alone. If it shall continue to be a factor in improving the agricultural interests of the State, it must each year endeavor to do better work. Progress is the watchword for societies as well as individuals.

The society was organized as an educator and instructor. Section one of the act creating the society makes it a body corporate "for the purpose of promoting the improvement of agriculture and its kindred arts," and section three requiring a report, says that "it shall embrace such accurate details of the modes of cultivation, of keeping stock and of other important incidents as will acquaint farmers and others with the precise manner in which the valuable results recorded can be again attained." Article seven of the constitution as first adopted, provided that premiums should be awarded "having special reference to the most economical or profitable mode of competition in raising the crop or stock, or in the fabrication of the article offered," and it also required that before any premium be delivered "the person claiming the same should deliver in writing, a statement covering this ground with a view of showing accurately the exact resulting profit."

It occurs to me that the men who organized the society had a very complete and accurate view of the work that such a society should undertake. I am sorry to say that while the provisions I have quoted have been but indifferently complied with, there can be no doubt that if they had and the material thus gathered been published, we should have such volumes of facts and experiences in practical agriculture, horticulture, manufactures and domestic art as we do not now have, such as cannot be gathered from any other source and which would be of inestimable value to all who are or may be engaged in industrial pursuits.

While such a system may be too elaborate and require too much time, as the society is organized, yet I am sure that something can profitably be done beyond the mere awarding and distributing of prizes.

Let us go back to the old idea and practice of making the annual exhibit an educator and help to the public. Each animal placed on exhibition should have attached to its stall or pen in such form as can easily be seen and read, a card giving the breed, exact age, name and residence of exhibitor. Each exhibit of fruit should have attached, the name of the variety and where grown; exhibits of vegetables should have the same. Attached to samples of grain should be the name of the variety, yield per acre and kind of soil on which grown. Such information is of extreme value to all visitors and can easily be furnished. It occurs to me that exhibitors are equally interested with the society in giving such information and should co-operate in providing it. As far as possible, opportunity should be given for testing agricultural implements and machinery, that farmers may be able to see the comparative quality of the work done by the different implements used for similar purposes.

It would be interesting and educational, if in the main building there could be exhibited some of the leading manufactures of the State rather than making most of the sections mere bazaars of foreign goods.

The school exhibit at the last fair was an interesting and valuable feature, and I recommend that measures be taken to make it more extensive. If we interest the school children in the fair, we shall soon have a constituency that will continue to support the Society.

It may be your judgment that the semi-centennial anniversary can be appropriately commemorated in the line of a grand display of educational work in which not only the public schools, but the University, Agricultural College, Mining School and other institutions may be invited to take part.

Expert and honest judges are very important adjuncts of a successful exhibit. In the main, this Society has been fortunate in securing them. An effort should be made to have this judging of live stock in the ring of value to the public who may be present, and to this end the judge should be able to give some reasons publicly for his awards, and the name of the owner should be announced before the animals leave the ring. There is a demand from many live stock exhibitors that the judges of the respective departments shall be selected and their names published in the premium list or at some time previous to the fair. There are to my mind some objections to this plan, but if high minded, honorable men are always secured, I am inclined to recommend the plan as being just to honorable exhibitors.

The question of special attractions at the fair is one that is troublesome to the business committee. Visitors seem in these days to expect and demand something in this line, and suitable attractions need in no way interfere with the legitimate work of the fair.

Trotting and pacing races are denounced by some as not legitimate work of an agricultural society, and out of place at a fair. Properly conducted, they are attractive, and encourage the breeding of the only American breed of horses, "the standard bred" and are patronized by all classes of people, and I may say, cost the society but little net money after deducting the fee for entries and the receipts of the grand stand.

PREMIUMS.

Last year the premiums were slightly reduced with a view of aiding the Society to throw off its debt. Whether it is wise to restore the amount to its former value I leave with you. In general, I believe in diversifying the premium list so as to cover as many articles and lines of industry as possible, thus securing the interest and co-operation of all people and interests connected with the material interests of the State.

There are at least twenty-five breeders of Dorset Horn Sheep in the State and they ask for a class. The breeders of Tamworth Swine, I think, asked for one last year. It seems to me that these breeds have attained sufficient standing in the State to warrant a class in our premium list.

RENTS AND PRIVILEGES.

The department of rents and privileges has been criticized to some extent, and is somewhat troublesome to handle because of the liability to imposition by those who obtain privileges. The Midway at the Columbian Fair followed by that of Atlanta and other expositions together with the street fairs in numerous cities, have inaugurated features and exhibitions that are not always consistent with good morals and which ask for space at state and other fairs. The Society should protect itself by refusing admission to objectionable exhibitions or features, and promptly ejecting any who impose on it by false representation. The rule of the superintendent of 1898 requiring advance payment in full is a good rule to follow. It protects the Society from loss and at the same time protects the legitimate and honest party who pays his rent.

ADVERTISING.

While the Society has been holding fairs for fifty years, and the simple announcement of the date and place would seem to be sufficient to draw a large attendance, it is found that the numerous counter attractions that exist in these days make extensive advertising of the annual fair necessary. From what experience I have had, I believe this to be important, and recommend liberal appropriations in this line with the expectation of good returns. The best method of advertising, I leave to your judgment or to that of the business or advertising committee who may be selected. In this connection I may say, what you all know to be true, that to make the annual fair a success, the co-operation of the various railroads of the State is needed. The managers have heretofore been liberal with the Society and I hope the mutual friendly relations may be maintained, for the benefits are also mutual. Low rates of fare are the greatest inducements to bring people out, and when these are secured, success is assured.

The city of Detroit is preparing to hold a bi-centennial exposition in 1901, which shall be of magnitude, covering not only the State, but several states and the Dominion of Canada. It is manifest that if this exposition is held, no State fair can be held that year. Farther than this, the State Agricultural Society is the legitimate and natural instrument to assist the management of this exposition in securing an exhibit of live stock and agricultural products commensurate with the standing of the State in agricultural interests.

If the exposition association could be induced to put the management of this part of the exposition in charge of this Society it would bring to the work an experience which I feel sure would greatly aid the exposition in securing a successful exhibit in these departments.

I suggest that steps be taken to bring the Society into mutual relations with the exposition management and secure some suitable arrangement for co-operation in this line.

The success of this Society is due to the untiring, self-sacrificing labors of its officers, who give time and labor without price. Co-operation and unity of action by such a body of men will always bring success. Let us this coming year, as in the past, combine our efforts to bring prosperity to the Society in this semi-centennial year.

The Michigan Buggy Company was presented with a silver cup offered for the best exhibit for three consecutive years.

The secretary presented several petitions to the legislature for State aid which had been secured by vote of the executive committee. On motion of Mr. Ball they were laid on the table.

The president appointed committee on premium list: Ball, Reed, Boyden, Lessiter, Barnes, Maynard, Rice. Also committee on rules: Fifield, Hinds, Hardy.

A recess was taken to the call of the president.

Wednesday evening, February 1st. Committee called to order by the president. Quorum present.

The premium list committee reported, with few changes from the list of 1898. The class for milch cows to be tested on the grounds was stricken out. Dorset Horns were added to the sheep classes. Tamworths were added to the swine classes. The report was adopted. (See premium list for 1899.)

On motion the secretary was authorized to procure separate entry tags for classes in which no premiums are awarded.

On motion the committee proceeded to the election of a member in place of N. J. Kelsey, resigned.

Mr. S. O. Bush, of Battle Creek, was nominated. On motion the secretary was instructed to cast the ballot of the committee for Mr. Bush. Ballot so cast and Mr. Bush declared elected to fill vacancy.

Mr. T. D. Seeley appeared before the committee in behalf of himself and other parties in relation to premiums unpaid of 1892, protesting against accepting 50 per cent of balance due in full. After remarks and conference, however, Mr. Seeley agreed to accept the offer, and the secretary was intructed to draw an order for the amount.

On motion of Mr. Skeels the committee on rules were instructed to report a rule providing that all rents and privileges must be paid for in advance of the fair.

On motion of Mr. Ball the dates for the fair of 1899 were made September 25-29.

The following resolution was adopted:

Resolved, That the executive committee hereby expresses its confidence in the honesty and business ability of Mr. F. E. Skeels, and appreciates the action of the State Board of Agriculture in restoring Mr. Skeels to the position of agent for Agricultural College lands.

On motion of Mr. Young the location of the next fair was left with the business committee.

A recess was taken to 9 o'clock A. M. Thursday.

On meeting Thursday morning the roll was called. Quorum present.

On motion of Mr. Hinds the president and secretary were authorized to prepare a new list for the dairy department with prizes in their discretion.

The committee on rules reported some minor changes. The report was adopted. See premium list for 1899.

On motion of Mr. Rice the chairman of the business committee was allowed $200 for services for 1898.

On motion of Mr. Jones the petitions obtained to be presented to the legislature were taken from the table and action thereon was indefinitely postponed.

On motion the election of general superintendent was taken up. Mr. Eugene Fifield was nominated.

On motion of Mr. Ball the secretary was directed to cast the ballot of the committee for Mr. Fifield. Ballot so cast and Mr. Fifield declared elected.

On motion of Mr. Lessiter the secretary was directed to cast the ballot of the committee for Eugene W. Jones for member of the business committee. Ballot so cast and Mr. Jones declared elected.

On motion of Mr. Young an additional member was added to the business committee, said member to be chosen by the present business committee.

The business committee reported that they had selected the president as additional member of that committee.

On motion a committee of three, Messrs Maynard, Ball, Hinds, was appointed to prepare a revision of the constitution to present to the Society at the annual meeting in September.

Mr. Ball offered the following:

Resolved, That if arrangements satisfactory to the business committee can be made with the West Michigan Society, the citizens of Grand Rapids in relation to a guarantee fund, and the railroad entering Grand Rapids, it is the sense of this committee that the fair be held at Grand Rapids.

On motion of Mr. Ball the salary of the treasurer for 1899 was fixed a $200, with a bond of $10,000.

On motion of Mr. Hardy the salary of the secretary for 1899 was fixed at $575.

A recess was taken for 15 minutes. On reassembling, Mr. Fifield, of the business committee, reported a contract with the West Michigan Society, for holding the fair on its grounds.

On motion of Mr. Ball the contract was accepted.

The president announced committees and executive superintendents for 1899 as follows:

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS COMMITTEE.

Eugene Fifield, Eugene Jones and Secretary.

TRANSPORTATION COMMITTEE.

L. J. Rindge, Eugene Jones, S. O. Bush.

PROGRAM COMMITTEE.

Eugene Fifield, H. H. Hinds and Secretary.

RECEPTION COMMITTEE.

J. E. Rice, L. J. Rindge, M. P. Anderson.

PREMIUM LIST COMMITTEE.

William Ball, F. L. Reed, W. E. Boyden, John Lessiter, L. W. Barnes Frank Maynard, J. E. Rice.

COMMITTEE ON RULES.

Eugene Fifield, H. H. Hinds, E. W. Hardy.

FINANCE COMMITTEE.

H. R. Dewey, F. E. Skeels, John McKay.

GENERAL SUPERINTENDENT.

Eugene Fifield.

CHIEF MARSHAL.

H. H. Hinds.

EXECUTIVE SUPERINTENDENTS.

Cattle—W. E. Boyden.

Horses, Speed—Eugene Fifield.

Horses, Roadster, Draft and Pony Classes—H. H. Hinds.

Sheep—John Lessiter.

Swine—L. W. Barnes.

Poultry—C. W. Waldron.

Dairy, Bees and Honey—M. J. Gard; G. H. True, Asst.

Farm and Garden Products—F. L. Reed.

Vehicles—S. O. Bush.

Agricultural Implements and Machinery—W. P. Custard.

Manufactured Goods and Supt. of Main Building—F. E. Skeels.

Art—F. E. Skeels.

Needle Work and Children's Work—Mrs. F. E. Skeels.

Special and School Exhibits, except Specials on Fruits—Frank Maynard.

Horticulture—R. D. Graham.

Gates—William Ball.

Police—E. W. Hardy.

Forage—W. E. Boyden.

Booths and Privileges—H. R. Dewey.

Miscellaneous Exhibits—John McKay.

On motion the committee adjourned.

On March 18th Secretary Fralick presented his resignation.

Permission having been obtained by letter from the members of the executive committee, the business committee met at Grand Rapids April 25, to fill the vacancy. After consultation with several members of the executive committee present, the president, I. H. Butterfield, presented his resignation, and on motion of Mr. Fifield was elected secretary, which election was later confirmed by the executive committee at a regular meeting.

I. H. BUTTERFIELD,
Secretary.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1899.

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